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Achievement-Relevant Personality
Relations with the Big Five and Validation of an Efficient Instrument

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Achievement-Relevant Personality
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Abstract

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A plethora of personality constructs have been proposed, and associated measures developed, to capture behavioral tendencies relevant to academic achievement. For example, individual differences in aspects of motivation, curiosity, studying behaviors and evaluations of the importance of school have been linked with achievement. However, there is little understanding of whether and how different achievement-relevant personality measures (APMs) relate to one another or to broader dimensions of personality. The current project examined the dimensionality of achievement-relevant personality constructs, their associations with the Big Five personality traits, and associations with academic performance. In Study 1, 214 college students were measured on 36 independent APMs along with a well-established, measure of the Big Five traits. Factor analytic results supported the convergent and discriminant validity of five latent dimensions: performance and mastery approaches to learning, self-doubt, effort, and hungry mind. Each factor and the individual scales that composed the factors possessed a distinctive pattern of associations with the Big Five. Conscientiousness,

neuroticism, and openness to experience had the most consistent associations with APMs. Based on the results of the first study, we next constructed a more efficient scale of APMs – the Multidimensional Achievement-Relevant Personality Scale (MAPS). In Study 2, we replicated the factor structure of the MAPS and its associations with the Big Five in a sample of 359 individuals. Additionally, we validated the MAPS with four indicators of academic performance. Although the factors assessed by the MAPS overlap somewhat with general indicators of personality, there was some evidence of incremental prediction of achievement.

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Chapter 1: Introduction

One of the oldest and most established research questions posed by psychologists is what personal characteristics enable individuals to learn and acquire new knowledge or skills (Ebbinghaus, 1964/1885). Historically, research on learning and achievement focused on intelligence (e.g. Galton, 1896; Binet, 1905; Spearman, 1904; Terman, 1916), with some early definitions of intelligence even being defined as the capacity to learn or profit from experience (i.e. "Intelligence and its Measurement: A Symposium," 1921). This research orientation persists to the present day, so much so that academic achievement has become the "criterion par excellence" to validate any measure of intelligence (Chamorro-Premuzic & Furnham, 2006, p. 253). Following theoretically from Cronbach's (1949) distinction between maximal and typical performance, there has been an increasing awareness that assessing intelligence as maximal performance likely misses aspects of typical performance that influence academic achievement. Indeed, Ackerman and Rolfhus (1999) point out that "abilities are only one part of the complex causal framework that determines whether a student pursues the acquisition of knowledge and skills within a particular domain" (p. 176). In addition to ability, determinants of typical performance such as personality, motivation, or interest may have direct, indirect, or interacting effects on academic achievement. To tap these determinants of typical performance, a diverse number of achievement-relevant personality measures (APMs) have been developed by researchers hailing from both differential psychology and educational psychology traditions.

In the sections that follow, we provide an overview of how researchers from each of these fields have approached the evaluation of achievement-relevant personality. Throughout our review, we highlight the uncertain links among the various measures described, and the outstanding need to link the various APMs currently in existence to one another and to the broader, established taxonomy of personality traits. We then provide the results of two empirical investigations designed to achieve these goals and finally comment on how our results might be used to better inform continuing research on the personality-achievement interface.

THE DIFFERENTIAL PSYCHOLOGY TRADITION

The Big Five personality traits – extraversion, agreeableness, conscientiousness, neuroticism, and openness to experience – are thought to provide a nearly comprehensive description of variation in human behavioral tendencies (Digman, 1990; Goldberg, 1993; John & Srivastava, 1999). In the most popular operationalization of the Big Five, the NEO-PI-R, each trait resides hierarchically over six more specific facets (Costa & McCrae, 1992). For example, the domain of agreeableness comprises the facets trust, straightforwardness, altruism, compliance, modesty, and tendermindedness. The codification of five simple, replicable, and highly predictive personality traits unified what was previously a "chaotic plethora" of different measures (Funder, 2001, p. 200). As such, the Big Five traits have proven to be extremely productive constructs for personality researchers interested in academic achievement and provide a model for the benefit of unified and relatively universal construct measurement.

Two authoritative reviews serve to describe the theoretical and empirical consensus regarding associations between the Big Five and academic achievement. De Raad and Schouwenburg (1996) used the Big Five framework, relatively novel at the time, to organize previous research using other personality constructs to make predictions about likely future findings of Big Five-achievement associations. For example, they speculated that extraverted students might be more likely to achieve in school because of higher energy levels or by benefitting from the social nature of school. Agreeable students might show higher levels of achievement because they are more likely to comply with teacher instruction and work cooperatively with other students. Conscientious students might have higher achievement due to increased determination or accuracy in completing assignments. Neuroticism might interfere with achievement by increasing levels of stress, particularly in testing situations. Finally, student openness might be related to prerequisites for learning such as curiosity or interest. A more recent meta-analysis investigated these claims by combining the results of 80 studies and 70,000 participants (Poropat, 2009). This study confirmed De Raad and Schouwenburg's (1996) predictions concerning the associations between academic performance (typically course grades

or GPA) and agreeableness (*r* corrected for unreliability = .07), conscientiousness (*r* corrected for unreliability = .22), and openness (*r* corrected for unreliability = 12). For comparison, the corrected *r* for intelligence and academic performance was estimated at .25.

Of course, personality-achievement correlations that focus on broad traits do not place strong limits on the extent to which specific facets of personality correlate with achievement. If a specific facet of a broad trait is the primary basis for the trait's associations with achievement, then one would expect the specific facet to correlate even more strongly with achievement in comparison to broad traits. Measures that possess greater detail than the Big Five may reveal unique relations that are obscured when measured at a broad domain level (Paunonen and Ashton, 2001a). Narrow measurement has been found to better predict academic performance (Luciano, Wainwright, Wright, & Martin, 2006; Paunonen & Ashton, 2001b), with a recent meta-analysis (O'Connor and Paunonen, 2007) concluding that "facets presumed to underlie the broad Big Five personality factors are generally stronger predictors of academic performance than are the Big Five personality factors themselves" (p. 971). These types of findings have led some researchers (e.g., Briley & Tucker-Drob, 2012; DeYoung, Quilty, & Peterson, 2007) to argue for the increased use of narrow measurement of personality dimensions rather than the broad, domain-level measurement found with the Big Five. In particular, differential psychologists have focused on two constructs that share large similarities with certain Big Five domains, but are supposed to be especially relevant to academics by tapping into specific mechanisms of the personality-achievement association. These constructs are effort, which is conceptually related to conscientiousness, and intellectual curiosity (a "hungry mind"), which is conceptually related to openness.

As described above, conscientiousness has been found to have the most consistent relation with academic performance (Blickle, 1996; Busto, Prins, Elshout, & Hamaker, 2000; Chamorro-Premuzic & Furnham, 2003a, 2003b, 2006). Several explanations for the association have been advanced: conscientiousness may reflect strength of character, a general sense of willpower, or a compensation strategy for lower levels of cognitive ability (Alexander, 1935; von

Stumm, Chamorro-Premuzic et al., 2011; Webb, 1915). The broad domain of conscientiousness includes facets that represent many different personality characteristics that may all or individually be related to academic achievement. Little progress has been made in determining what aspect or facet of conscientiousness is most influential, but the construct of effort has received considerable attention and has the potential to reflect each of the above explanations (Chamorro-Premuzic & Furnham, 2005). Effort refers to an individual's care and persistence in a given activity. Different measurement perspectives have been used to assess effort including constructs ranging from procrastination to perfectionism (Lay, 1986; Frost, Marten, Lahart, & Rosenblate, 1990). We incorporate several different measures of effort in an attempt to determine how this construct relates to other APMs.

A hungry mind, conceptually related to openness or intellect, is another construct that has been linked to achievement (von Stumm, Hell, & Chamorro-Premuzic, 2011). Hungry mind measures were developed by differential psychologists seeking to test Cattell's (1941, 1943, 1971, 1987) investment theory, which held that in combination with interest and motivation, intelligence was invested over time in learning activities that result in knowledge acquisition. This theory was developed to more fully incorporate personality in Ackerman's (1996) conceptualization of intelligence-as-process, personality, interests, and intelligence-as-knowledge (PPIK). In addition to interest and motivation, individual differences in personality constructs also influence the investment of intelligence. Possessing a hungry mind is a likely personality trait to be associated with increases in learning or performance in school. Curiosity has been found to be associated with academic performance and may therefore represent a specific aspect of personality that is relevant for investment in learning (Cacioppo, Petty, Feinstein, & Jarvis, 1996; von Stumm, Hell et al., 2011). Some disagreement exists in the choice of preferred instrument. Initial organizing work has been conducted to show that different measures of hungry mind lack discriminant validity (Mussel, 2010). Further, an analysis of the item content from different scales reveals many semantically identical items (von Stumm, 2010).

Several slightly different aspects of a hungry mind were included in the current study to evaluate the possibility of differential relations with other APMs.

Although the Big Five, and associated subfactors, provide a consistent framework from which to judge the relations between individual difference and academic achievement, there is considerable evidence for traits that are *outside* Big Five factor space (Paunonen & Jackson, 2000). This is particularly the case for traits that are thought to be highly influenced by situations or that only apply in certain contexts. These types of dimensions are specifically left out of the Big Five in an effort to describe broad, enduring, and consistent indicators of behavior. Behavioral tendencies that primarily occur in the schooling context are crucial for understanding achievement and have generally been treated as outside the purview of the Big Five. Such tendencies have traditionally been neglected in personality research but strongly focused on in educational research.

THE EDUCATIONAL PSYCHOLOGY TRADITION

Educational researchers place importance on individual differences that relate to student perceptions, attitudes, and goals within the context of school. Theories of academic goal orientation describes various approaches to learning that emerge in the context of challenging educational situations and are marked by motivations to either demonstrate or obtain competence (Ames, 1984; Dweck, 1986; 1999; Elliot, 1999; VandeWalle, 1997). Although many different labels have been used in this literature, the most common distinction made is between performance and mastery orientations (see Elliot, 2005 for a description of the distinct, but highly congruent, theoretical backgrounds). Performance goal oriented individuals have a desire to demonstrate their competencies to others. Mastery goal oriented individuals, in contrast, have a desire to complete challenging tasks that may increase their competence in some area. Goal orientations have also been further distinguished as approach tendencies, where the student is driven to display indicators of performance or mastery, or avoidant tendencies, where the student is driven to hide indicators of a lack of performance or mastery (Elliot & Harackiewicz, 1996).

Thus, a student who possesses a performance-approach orientation would desire to outperform other students, and a student with a performance-avoid orientation would desire to not give a wrong answer in class. Goal orientations tend to focus on why students study, but there are also individual differences in how students study. Applied specifically to studying behavior, the constructs of deep and surface study processes describe students who seek to learn course material completely and those who seek to only learn the minimum that is required, respectively (Biggs, Kember, & Leung, 2001).

Approaches to learning are thought to influence academic achievement by way of guiding studying behavior and motivation in school (Elliot & Murayama, 2008). Swanberg and Martinsen (2010) found that performance and mastery orientations predicted grade achievement above and beyond several controls, including the Big Five. However, a recent meta-analysis called into question the utility of the approaches to learning construct (Huang, 2012). This study confirmed the discriminant validity of the four factor performance-mastery and approach-avoid model, but found that these constructs accounted for only very small proportions of the variance in academic achievement. Part of the confusion may stem from the uncertain association between different operationalizations of the construct, many of which were included in the analyses. For example, the performance-approach construct has been found to both positively and negatively predict achievement depending on aspects of the item content (Hulleman, Schrager, Bodmann, & Harackiewicz, 2010). This highlights the need to evaluate the psychometric properties of approaches to learning in order to provide a consistent theoretical picture.

The motivational attributes that follow from evaluations of the self or school environment are the final domain that this article will attempt to integrate. The Expectancy-Value model (Eccles, 1987, 1993, 2005), recently reframed as the Expectancy × Value model (Nagengast, Marsh, Scalas, Xu, Hau, & Trautwein, 2011), is one of the most influential theories of academic motivation. This model predicts that academic motivation results from a combination of student's beliefs about their ability to successfully complete a task and how much they value the outcome. According to the Expectancy × Value version of this model, for a student to be

academically motivated, both expectancy and value must be high. If a student does not believe the task can be completed, there will be little motivation to complete the task no matter how valuable completion may seem. Similarly, if the task holds no value, the student is unlikely to complete even the easiest of tasks. A core component of the Expectancy × Value model is that assessments of the self and the environment can have a large influence on the pursuit of academic achievement (Nagengast et al., 2011). This model parallels work in I/O psychology by Judge, Locke, and Durham (1997), who have developed and articulated the importance of "core self-evaluations," such as self-esteem, locus of control, emotional stability, and self-efficacy in both job performance and academic achievement (Judge & Hurst, 2007). Other researchers have constructed similar measures that are contextualized within the academic classroom to assess a student's evaluations of academic self-worth or efficacy (Midgley et al., 2000). Marsh, Köller, Trautwein, Lüdtke, and Baumert (2005) have demonstrated the reciprocal effects between academic self-concept and achievement. Those that have a high self-concept tend to attain higher levels of achievement, and those that attain higher levels of achievement tend to have higher self-concepts even when previous levels are controlled for using longitudinal data. Wigfield and Cambria (2010) note that incorporating self-concept and beliefs within the framework of other APMs is essential for understanding why student outcomes change over time.

A Need For Integration

As surveyed above, many APMs are in use, but little has been done to integrate findings driven by different theoretical backgrounds. A coherent organizing framework or theory can advance the field by uniting isolated measures or findings (Furnham, 2011). Several recent reviews have commented on the need for a multivariate examination of the interrelations among the many APMs in order to establish the convergent and discriminant validity of different operationalizations. In Ackerman and Heggestad's (1997) influential meta-analysis of investment traits, they concluded that the various investment constructs are "isolated personality measures … with no linkage to any personality theory" (p. 222). Citing this rather clear call for future

research, von Stumm, Chamorro-Premuzic, and Ackerman (2011) quizzically determined that "a unifying research endeavor is yet to be undertaken" despite the clear interest in the topic and the length of time between the initial and recent review (p. 225). Additionally, Furnham (2011) argued that a renaissance of sorts in APM research can be accomplished by placing these constructs within the well-established Big Five framework. Wigfield and Cambria (2010) comprehensively describe the many similar APM constructs within educational psychology and note that there is little information about how different operationalizations relate to each other. In their review, a table spanning three pages is required to display all of the commonly used APMs. Despite these calls, a comprehensive, multivariate synthesis has yet to be undertaken.

Two meta-analytic studies are noteworthy for moving the field in this direction. First, Hulleman et al. (2010) focused on the approaches to learning construct to determine if the measures that different research groups gave similar labels measured the same construct. The researchers coded the item content of different scales based on rational grounds and meta-analyzed data from 243 studies comprising more than 90,000 participants. Indirect evidence was found for the same label being applied to different constructs in that the measures that were coded by the researchers as possessing different item content produced different patterns of correlates with achievement. Although this method convincingly demonstrates the measurement confusion in the approaches to learning domain, it relies on coding item content based on face validity to make the argument. We will complement this finding by assessing the empirical associations between different instruments. Second, Richardson, Abraham, and Bond (2012) conducted a comprehensive meta-analysis of correlates of academic performance including demographic factors, ability, previous performance, and many APMs. This study is important for establishing that many of the constructs assessed by APMs are related to academic achievement and that there is sometimes significant overlap among constructs. For example, the large zero-order relation between conscientiousness and achievement was found in the study, but when conscientiousness was included in a model with other APM constructs, conscientiousness did not explain any additional variance. Richardson et al. (2012), however, did not examine the factor

structure underlying the multivariate relations among APMs. In fact, the authors concluded that the "development of an improved multimeasure assessment instrument would provide more parsimonious and reliable assessments" (Richardson et al., 2012, p. 374). We will attempt to take up this challenge.

By establishing an integrative taxonomy of APMs, future research can proceed in a more efficient and productive manner to determine the traits that are truly important to measure. Measures that do not significantly predict achievement or those that do not provide incremental prediction can be removed from the domain of APMs. This article proposes to aid progress in this direction for the field in three ways. First, establishing clear links between APMs and the Big Five will allow for an integration of the empirical results and overarching theories that explain the effect of personality on academic achievement (Furnham, 2011). The Big Five represent a conceptual map of the primary dimensions of variation in personality and can be used to contextualize the structure of APMs in reference to the larger personality landscape. Second, exploring the internal structure of the APMs will help to generate a coherent taxonomy of measures by establishing convergent or discriminant validity of different measures. Third, consolidating and refining the item content of many different scales to produce parsimonious scales that are validated with academic achievement will allow for efficient measurement of the constructs that influence participation in the classroom.

THE PRESENT PROJECT

We provide evidence from two studies. In the first study, we included a total of 36 APMs from the content areas of approaches to learning, effort, hungry mind, and self and school evaluations. Measures were selected based on their widespread use and their emphasis in recent reviews. The Big Five were included to provide a reference point of accepted, broad personality traits. In light of previous reviews (Furnham, 2011; von Stumm, Chamorro-Premuzic, et al., 2011; Wigfield & Cambria, 2010), we attempted to fully explore the within-APM nomological network with factor analysis and by situating the APMs in the context of the Big Five before

attempting to link the constructs with other outcomes (Cronbach & Meehl, 1995). Additionally, we conducted item-level analyses to remove redundant item content and create a reduced self-report instrument to assess the major constructs that were uncovered. In the second study, we replicated the factor structure of the reduced scales and validated them with academic achievement. By piecing together these separate frames of reference, our goal is to offer an interpretive guide that allows the disparate measures and theoretical orientations to be compared.

Chapter 2: Study 1

METHOD

Participants

This study used the undergraduate research participant pool at a large, public research institution in Texas. Participants were recruited through an online database of available studies, and they participated as part of the research requirement of a foundational psychology course. The original sample consisted of 249 individuals. Thirty-five participants were removed from the sample because they did not correctly respond to one or more of seven validation items (e.g., "Please select option three for this question"). The final sample of 214 individuals included 153 (71.5%) females and 61 (28.5%) males. Participants ranged in age from 17 to 23 with the majority reporting being 18 or 19 years old (n = 179, 83.6%). The majority of participants were college freshmen (n = 133), but the sample also included sophomores (n = 58), juniors (n = 13), and seniors (n = 9), with one participant not reporting a grade. The racial/ethnic composition of the sample was relatively diverse, containing participants who were non-Hispanic White (n = 128, 59.8%), Asian (n = 50, 23.4%), Hispanic (n = 48, 22.4), Black (n = 16, 7.5%), American Indian (n = 5, 2.3%), and Other race/ethnicity (n = 22, 10.3%).

Measures

A diverse array of measures from five measurement domains was included in the current study: approaches to learning, effort, hungry mind, self and school evaluations, and the Big Five. All items were rated on a scale ranging from 1 to 7, with 7 representing strong agreement with the statement and 1 representing strong disagreement. The use of a 7-point scale has been shown to approximate a continuous variable that can be empirically analyzed using traditional approaches such as factor analysis rather than approaches designed for categorical measurement such as item-response theory (Rhemtulla, Brosseau-Liard, & Savalei, *in press*). Means, standard deviations, and reliability estimates are presented in Table 1 for the APMs and Table 2 for the Big Five measures and their facets. The majority of APMs displayed adequate levels of

reliability. By using a scoring procedure designed to minimize acquiescent response sets (described in Soto & John, 2009), the metric on which the Big Five measures and facets are based is less interpretable than for the APMs. The average reliability estimate was .80 with a range of .43 to .95. Locus of control and three Big Five facets (order, depression, and aesthetics) had estimated reliabilities of less than .6, indicating that correlational patterns involving these scales are likely to be more attenuated than those involving the remaining, more reliable tests.

Approaches to learning

Measures in this content area reflect individual differences in the goals or strategies that students might use in learning domains. We included three widely used operationalizations of this construct: the Achievement Goal Questionnaire (AGQ; Elliot & McGregor, 2001), Study Process Questionnaire (SPQ; Biggs et al., 2001), and the Patterns of Adaptive Learning Scales (PALS; Midgley et al., 2000). The AGQ is a 12-item scale representing four largely unrelated factors that describe student aims within the classroom. Elliot and McGregor (2001) labeled these factors as performance-approach ("It is important for me to do better than other students"), performance-avoid ("My goal in this class is to avoid performing poorly"), mastery-approach ("It is important for me to understand the content of this course as thoroughly as possible"), and mastery-avoid ("I'm often concerned that I may not learn all that there is to learn in this class"). While originally designed to be used in regard to specific courses, Finney, Pieper, and Barron (2004) demonstrated that the items could be adjusted to assess a general orientation towards school and learning. This adjustment was used in the current study. Reported reliability estimates are high for all scales and range from .83 to .92 (Elliot & McGregor, 2001).

The SPQ contains twenty items that assess whether students tend to approach learning tasks from a deep perspective, in which internalizing the entirety of the material is seen as intrinsically rewarding, or a surface perspective, in which learning what will be required in a testing situation is approached pragmatically (Biggs et al., 2001). Sample questions include "I find that I have to do enough work on a topic so that I can form my own conclusions before I'm

satisfied" assessing a deep strategy, and "I only study seriously what's given out in class or in the course outlines" assessing surface strategy. Biggs and colleagues (2001) report reliability estimates of.73 for the deep process scale and .64 for the surface process scale.

The student personal achievement goal orientation scales from the larger PALS materials were included in the materials (Midgley et al., 2000). Similar to the AGQ, the PALS scales conceptualize student goals in terms of performance and mastery. The performance construct is further subdivided into approach and avoid categories. The items that assess a mastery orientation are all indicative of an approach perspective. Additionally, revised versions of each scale were included as well as originals. The revised scales attempted to remove references to specific behaviors or the intrinsic value of certain outcomes in an effort to assess learning orientations rather than student interest in different types of activities. We included each student scale in order to further evaluate how the original and revised scales relate both to each other and to the other measures included in the materials to provide a more complete picture of the construct. Sample items include "I like class work that I'll learn from even if I make a lot of mistakes" assessing mastery goal orientation, "It's important to me that other students in my class think I am good at my class work" assessing performance-approach orientation, and "One of my goals is to keep others from thinking I'm not smart in class" assessing performance-avoid orientation. Reported reliability estimates for each scale are high ranging from .74 to .89 (Midgley et al., 2000). Each scale contains four to six items.

Effort

We included measures that tapped into a broad range of positive and negative aspects of motivation including measures of procrastination, perfectionism, and desire for accomplishments. First, a measure of procrastination was included as a negative marker of effort. The procrastination scale includes twenty items such as "I often find myself performing tasks that I had intended to do days before" and "Even with jobs that require little else except sitting down and doing them, I find they seldom get done for days" (Lay, 1986). The Frost

Multidimensional Perfectionism Scale (FMPS) contains 35 items and was included (Frost et al., 1990). This measure assesses different manifestations of perfectionistic thinking such as a concern over mistakes ("If I fail at school, I am a failure as a person"), personal standards ("I have extremely high goals"), parental expectations ("My parents wanted me to be the best at everything"), parental criticism ("My parents never tried to understand my mistakes"), doubts about actions ("I tend to get behind in my work because I repeat things over and over"), and organization ("I try to be an organized person"). Frost and colleagues (1990) demonstrated that all of these subcomponents of perfectionistic tendencies are largely interrelated, but each has its own distinct content and outcome relations. Reported reliability estimates for the subscales range from .77 to .93. A measure of achievement striving containing ten items was obtained from the International Personality Item Pool (IPIP; Goldberg et al., 2006). This scale includes items such as "Turn plans into actions" and "Do just enough work to get by" as a negatively keyed item. The reported reliability estimate of this scale is .78.

An additional scale that measured a largely positive view of general effort or initiative that could include work, school, or social life was sought, but we found most to be either domain specific or relating to perseverance in the face of adversity (e.g., the Short Grit Scale; Duckworth & Quinn, 2009). While perseverance is certainly related to effort, an investment trait related to exposing oneself to new experiences or activities may provide a more direct explanation for the link between conscientiousness and academic achievement. Individuals that are simply predisposed to pursue opportunities to learn rather than remaining content with their current environment may be more likely to achieve academically. For example, if two students are interested in learning about world history, but only one has the drive to pursue this interest, then the students will have very different learning outcomes. The driven student may go to a museum, ask an expert, or obtain books about the topic. One goal in constructing this scale was to behaviorally mirror the cognitive process that takes place in a hungry mind. It is conceivable that two individual students would possess equal levels of hungry mind investment traits, but they would differ on behavioral activity traits which would lead to differences in learning. As such,

this scale may be seen as a linkage between general activity level (a component of extraversion), curiosity (a component of openness), and most importantly the follow through to pursue the interest with effortful behavioral actions. Sample items of the newly created scale include highly face valid statements such as "I seek out activities that interest me," "I like to keep up to date on events related to my interests," and "I am motivated to expand my understanding of the topics that interest me."

Hungry Mind

Several scales relating to a desire for new ideas or complex situations were included in the materials such as tolerance for ambiguity, avoidance of novelty, ingenuity, intellect, quickness, creativity, depth, and love of learning. Tolerance for ambiguity is an 18-item scale that indicates a desire or lack of discomfort in situations that may be complex or with problems that lack a clear solution (Judge, Thoresen, Pucik, & Welbourne, 1999). Sample items include "In a situation in which other people evaluate me, I feel a great need for clear and explicit evaluations" as a negative indicator and "I enjoy tackling problems which are complex enough to be ambiguous" as a positive indicator. Judge and colleagues (1999) report a reliability estimate of .73 for the scale. Conversely, avoidance of novelty is a five item scale that refers to preferences for avoiding unfamiliar work in a classroom setting with items such as "I don't like to learn a lot of new concepts in class" and "I like academic concepts that are familiar to me, rather than those I haven't thought about before" (Midgley et al., 2000). The reported reliability estimate of this scale is .78. The remaining scales come from various constructs found in the IPIP (Goldberg et al., 2006). Ingenuity is a 10-item scale containing items such as "Love to think up new ways of doing things" and "Carry the conversation to a higher level." Intellect is an eleven item scale containing items such as "Make insightful remarks" and "Enjoy thinking about things." Quickness is a 10-item scale containing items such as "Catch on to things quickly" and "Am able to find out things by myself." Creativity is a 10-item scale containing items such as "Have a vivid imagination" and "Love to think up new ways of doing things." Depth is a 9-item

scale containing items such as "Look for hidden meaning in things" and "Think deeply about things." Finally, love of learning is a 10-item scale containing items such as "Go out of my way to attend educational events" and "Look forward to the opportunity to learn and grow." Reported reliability estimates of the IPIP scales range from .77 to .85. Together, these scales represent several related aspects of a hungry mind.

Self and School Evaluations

Self and school evaluations also play a large role in achievement and the perception of ability. Several of the measures that we utilized fall under the label of core self-evaluations (Judge et al., 1997). First, a 10-item self-esteem scale was included to assess the participants' general feeling of self-worth. Sample items include "I feel that I am a person of worth, at least on an equal basis with others" and "I certainly feel useless at times" as a negative indicator (Rosenberg, 1965). Next, a measure of generalized self-efficacy was included. Sample items for this 8-item scale include "I am strong enough to overcome life's struggles" and "I feel competent to deal effectively with the real world" (Judge, Locke, Durham, & Kluger, 1998). The final core-self evaluation, locus of control, was assessed with an 8-item measure with sample items such as "Whether or not I get to be a leader depends mostly on my ability" and "My life is determined by my own actions" (Levenson, 1981). Additionally, evaluations of the school or academic environment were assessed using measures from PALS (Midgley et al., 2000). A measure of academic efficacy was included as a domain specific area of efficacy. Sample items include "I'm certain I can master the skills taught in class this year" and "Even if the work is hard, I can learn it." Avoidance of achievement refers to aversions to behaviors that would showcase knowledge or ability in the classroom. Sample items of the 7-item scale include "I would avoid participating in class if it meant that other students would think I know a lot" and "It's very important to me that I don't look smarter than others in class." Skepticism about school refers to a student's belief that later life success is unrelated to academic achievement. Sample items of the 6-item scale include "My chances of succeeding later in life don't depend on doing well in school" and "Even

if I am successful in school, it won't help me fulfill my dreams." Reported reliability estimates for these scales ranges from .78 to .83. Finally, a 10-item scale assessing competence was taken from the IPIP (Goldberg et al., 2006). Sample items from this scale include "Come up with good solutions" and "Complete tasks successfully." The reported reliability estimate of this scale is .80.

Big Five

We used the Big Five Inventory as our measure of broad personality domains (John & Srivastava, 1999). This widely used instrument produces scores for the domains of extraversion, agreeableness, conscientiousness, neuroticism, and openness to experience. In lieu of the standard scoring approach of the instrument, we used the scoring criteria developed by Soto and John (2009) which provides ten facet scores in addition to the Big Five in order to provide a more fine grained analysis. Further, the updated scoring approach takes into account acquiescent response sets and reduces their effect on the composite scores. There are two facets for each Big Five domain. These facets are labeled assertiveness and activity for extraversion, altruism and compliance for agreeableness, order and self-discipline for conscientiousness, anxiety and depression for neuroticism, and finally, aesthetics and ideas for openness to experience. Not every item of the Big Five Inventory is associated with a facet measure. The Big Five contain items, and thus variance, that are unique from the facet measures. For the scoring procedure and the item content, please see Soto and John (2009).

Procedure

All self-report materials were completed in a laboratory setting with a research assistant overseeing the data collection. The measures were administered using the REDCap data management system (Harris, Thielke, Payne, Gonzalez, & Conde, 2009). The laboratory was equipped with three computers in separate, small rooms. This procedure ensured that the participants experienced a private and distraction-free environment to complete the instrument in the presence of a research assistant to answer any questions about the study.

Analytic Approach

We proceeded with the analyses in distinct steps. First, we examined how the individual APMs related to well established personality traits. We used multiple regression to simultaneously predict each APM with the Big Five. These analyses provide a conceptual map of the placement of each APM in a well-established personality framework. By examining the proportions of variance accounted for in each APM by the Big Five, we were able to evaluate how independent the APMs are from typical, broad personality measures.[1]

Second, we used oblique exploratory factor analysis (EFA) to examine the structure of the APMs. We investigated scree plots of eigenvalues and conducted a parallel analysis to decide the number of factors to extract in a preliminary EFA, and we applied the confirmatory factor analysis (CFA) in EFA feature of M*plus* to regress the latent exploratory factors on the Big Five and the facets (Muthén & Muthén, 1998-2010). This technique allows for a seamless flow of analysis from exploratory to confirmatory interpretation and avoids model specification issues that are pragmatically unimportant. We interpreted the results in light of patterns of APM loadings on the extracted factors to descriptively label the factors and compare the results with that of the individual scales.

Third, we moved to an analysis at the item-level and specified separate (i.e. one factor) confirmatory factor models to the item content of the scales that loaded greater than an absolute value of .30 in the previous exploratory analysis. For example, if procrastination loaded .4 on factor 1, every item that comprises this scale would be included in a confirmatory model for factor 1 along with all of the items from other scales that loaded substantially on factor 1. The purpose of this analysis was to determine the extent to which the APM items from different scales actually measure largely similar constructs. Our decision to use the .30 value cutoff was

[1] The next logical step would be to individually predict each APM with the high fidelity, facet-level measures of the Big Five to determine what sub-construct of the Big Five drives the association. For example, does the facet of anxiety or depression drive an association between an APM scale and neuroticism? However, due to the large number of statistical tests (360) associated with using ten facets to predict each APM and the space requirements to describe all of the results, we will not present the results of the facet-level analysis. This avoids capitalizing on Type I errors and performing this level of analysis at later stages offers a clearer picture of the personality-APM relations. The full results of the facet-level analysis are tabulated and available from the authors

motivated by our desire to exclude trivial loadings (i.e. loadings in the -.30 to .30 range) while at the same time retaining weaker, yet potentially meaningful loadings (i.e. loadings in the .31 to .60 range) in addition to larger magnitude loadings. It is conceivable that a scale that has only a moderate loading on a latent factor could have a facet or item that is strongly associated with the general content of the factor. The ability to subsume disparate items obtained from measures with separate theoretical backgrounds under a single higher-order factor would indicate that the measures assess a similar construct. From this analysis, we created reduced 10-item scales based on the items that had the highest loading on the factor with two decision criterions: (1) to ensure that we sampled the entire range of item content, a maximum of three items from a single scale were chosen, and (2) if an item was selected for multiple factors, we retained it for the factor that it loaded most strongly on and selected a different item for the factor that it loaded less strongly. Additionally, we required at least two reverse coded items per scale. If one was not chosen under the current procedure, we changed the content of an item to be reversed typically by adding or removing the word "not." In practice, this procedure often included items from different scales that had semantically identical meaning. When this occurred, we reversed the meaning of one of the items, but kept the content the same. This allowed us to create an acquiescence index based on items that have opposite implications for participant personality. An acquiescent response set is defined by consistently agreeing (yea-saying) or disagreeing (nay-saying) with all test items. Using within-person centering based on this procedure has been found to produce more reliable and valid scale scores when there is an imbalance of forward and reverse coded items, as was the case in the current analysis (McCrae, Herbst, & Costa, 2001; Soto, John, Gosling, & Potter, 2008). To ensure that the items we selected had sound psychometric properties, we conducted a targeted exploratory factor analysis with the target being simple structure and constructed confirmatory models that regressed the reduced scales on the Big Five and the facets.

All models were fit using full-information maximum-likelihood estimation in M*plus* statistical software (Muthén & Muthén, 1998-2010).

RESULTS

Associations between APMs and the Big Five

Table 3 presents the standardized regression coefficients from regressing each APM individually on the Big Five domains. Based on the pattern of results, preliminary speculation about broader APM constructs can be made and placed within the broad personality taxonomy. Instruments designed to assess approaches to learning had associations primarily with conscientiousness, neuroticism, and openness. Extraversion did not significantly predict any of the approaches to learning measures, and agreeableness did so only once. Higher levels of conscientiousness were positively associated with mastery-approach orientations as measured by the AGQ and PALS, as well as with deep study processes. Further, conscientiousness was negatively related to mastery-avoid orientation as measured by the AGQ and surface study processes. With the exception of AGQ performance-approach, which was positively associated with conscientiousness, performance orientations were uncorrelated with conscientiousness. Higher neuroticism was associated with several of the measures, but the strongest relations were found with avoidant or performance orientations. Weak, positive associations with neuroticism were found for AGQ mastery-approach and surface study processes. Non-significant relations were found with PALS mastery orientations and deep study processes. Similar to the pattern seen for conscientiousness, openness was unrelated to performance orientations, positively associated with mastery orientations and deep study processes, and negatively associated with surface study processes. Finally, the broad Big Five domains accounted for a modest amount of variance in each measure ranging from 6% to 27% (mean = 16.8%).

In line with past research on measures of effort, conscientiousness was the primary Big Five domain associated with each measure of effort. Strong, positive relations were found between conscientiousness and doubts, organization, achievement striving, and motivation to pursue interests. Conversely, the procrastination and perfectionist standards are negatively related to conscientiousness. Interestingly, mistakes, parent expectations, and parent criticisms, which reflect views of self-image or the perceptions of others rather than effort specifically, are

unrelated to conscientiousness. Some other relations are noteworthy. For example, higher levels of neuroticism were found to be associated with the scales of mistakes, standards, and parent criticism. Openness was found to be positively associated with parent criticism, doubts, achievement striving, and strongly with motivation to pursue interests. Some small relations were found for extraversion and agreeableness. In total, the effort domain appears to be largely defined positively or negatively by indicators related to conscientiousness. Relations among smaller groups of measures with neuroticism and openness may indicate that there are sub-factors or cross-loadings with other factors within this domain. The amount of variance explained by the Big Five varied considerably across effort measures. Achievement striving displayed the largest amount of variance explained (48%), but a much smaller amount of the variance in parental expectations (8%) was explained.

As was expected, the hungry mind domain was highly related to openness. Furthermore, four of the eight hungry mind measures were negatively associated with neuroticism. Other minor associations were found with the remaining three Big Five factors. Four of the eight hungry mind measures were associated with lower levels of agreeableness, and three measures were associated with higher levels of conscientiousness. In general, though, hungry mind measures primarily relate to higher levels of openness. Substantial amounts of variance were explained for each measure ranging from 23% to 59%.

The final domain of self and school evaluations was largely associated with conscientiousness and lower levels of neuroticism. For six out of the seven indicators, more positive evaluations are associated with higher levels of conscientiousness. Additionally, four measures of positive evaluations were associated with lower levels of neuroticism. Importantly, the strongest associations with neuroticism are found for the self rather than school evaluations. No significant relations were found for agreeableness, but extraversion and openness significantly predicted the measures in three cases. Avoidance of achievement was unrelated to any of the Big Five with only 2% of the variance in the measure accounted for by the broad

personality domains. A moderate amount of variance was associated with the Big Five for the remaining measures (ranging from 11% to 52%).

To summarize, each domain displayed significant associations with the Big Five indicating that some aspects of the highly contextualized APMs relate to general personality traits. Evidence for the four postulated domains was found in the coherent patterns of within APM domain-Big Five relations. Despite the clear pattern of the major associations, individual measures of a domain possessed differential secondary or tertiary relations with general personality traits which sometimes resembled other domains. This may be an indication that the domains may not be entirely unitary or independent. Further, the Big Five were able to account for a significant portion of the variance in most measures, but it is unclear if the amount of variance that was explained by the Big Five or the relations with specific personality traits will be variance that is common to the different APMs or unique to each individual measure. The next step in constructing the nomological network is examining relations among the APMs.

Associations among APMs

An oblique, geomin rotated EFA of every APM was conducted. The first five eigenvalues (with the 95th percentile eigenvalues from a parallel analysis given in parentheses; O'Connor, 2000) were 8.95 (1.91), 5.69 (1.77), 2.67 (1.69), 1.99 (1.61), 1.62 (1.54) followed by 1.46 (1.48), 1.30 (1.44), 1.11 (1.39), .94 (1.34), and .82 (1.30). Because only the first five eigenvalues from the dataset exceeded those from the parallel analysis, a five factor solution was indicated (choosing 90th percentile did not change the five factor determination). However, based on the scree plot of eigenvalues from the dataset, we went on to select the three, four, five, and six factor solutions for closer inspections. We found that the five factor solution was most readily interpretable. Having decided to maintain the five factor solution, we fit an exploratory five factor model with structural components to regress the latent factors on the Big Five. The factor structure of the APMs is presented in Table 4, and the relations amongst the latent factors and the Big Five are presented in Table 5.

Factor 1 is defined by performance orientations as operationalized by the AGQ and PALS. Similar to the results of the individual scales, Factor 1 is associated with neuroticism. Moving to the results of the facet level analysis, low self-discipline and high anxiety were associated with Factor 1. Together, this indicates that Factor 1 is largely defined by the performance approaches to learning construct.

Factor 2 is defined by mastery orientations (AGQ, SPQ, and PALS) as well as three scales that were *a priori* placed within the hungry mind domain: avoidance of novelty, depth, and love of learning. Interestingly, deep and surface study processes as operationalized by the SPQ both loaded on this factor in a positive and negative direction, respectively. This indicates that in the current sample, the constructs represent two ends of a continuum rather than distinct constructs. Factor 2 is associated with higher levels of conscientiousness and openness at the broad domain level and self-discipline and ideas at the facet level. This pattern resembles that found for mastery orientation scales more than hungry mind as there was no association with neuroticism. Additionally, the specific scales from the hungry mind domain that load on this factor appear to have face valid content associated with mastery or learning classroom goals. We label Factor 2 as a mastery approaches to learning construct.

Factor 3 is largely defined by perfectionistic scales, low self-esteem and self-efficacy, and slightly by performance and surface approaches to learning. The predominant Big Five association is with neuroticism and, specifically, anxiety. Although the majority of these scales were intended to assess effort, this cluster appears to center around thoughts of doubt about one's value and abilities to complete tasks. As such, this factor will be labeled self-doubt.

Factor 4 reflects the remaining constructs in the effort and self and school evaluations domains. It is defined by traits indicative of organization, desire to succeed, self-worth, and a belief in the value of school and one's ability to compete in this environment. This cluster is very strongly associated with conscientiousness and both of its facets. Therefore, we label this factor as effort and note that effort is indicative of several evaluative constructs.

The remaining constructs largely come from the hungry mind domain which constitutes the majority of Factor 5. Additional scales that load substantially on this factor come from the effort domain reflecting the shared content of effort to complete tasks and effort required to seek out new information. This factor has a strong relation with openness to experience, particularly the ideas facet, and inverse relations with agreeableness and neuroticism. This factor will be labeled hungry mind.

Item-Level Analysis

Having placed the APMs in the broad context of the Big Five and discovered that the scales have overlapping content, the next phase of the analysis is to construct a reduced scale to efficiently assess the five factors. Single factor confirmatory models were analyzed that included the items of each construct that loaded greater than an absolute value of .30 in the exploratory results (see Table 4). From these models, the ten highest loading items were selected as representative of that construct following the procedures outlined in the analytical approach. All loadings were significant with a minimum absolute value of the standard loading of .56 and a mean of .71. Similarly, the reliability of each scale derived from this procedure was uniformly high and greater than .90 in each case. The resulting items are highly face valid indicators of the labels assigned to the factors extracted from the exploratory analysis and are a dramatic reduction in the number of items (50 compared to 268). This reduced instrument will be labeled the Multidimensional Achievement-Relevant Personality Scale (MAPS).

The combined psychometric properties of the MAPS were evaluated using oblique EFA with target rotation aimed for simple structure. The results of this analysis are presented in Table 6 and confirm the simple structure of the scale. Finally, the scores on the reduced scales were predicted by the Big Five and the facets. The results largely resemble that which was found with the latent factors, and therefore for space reasons they are not presented. For item content and scoring procedure including creating of the acquiescence index and reverse coding of the final scale, please see the Appendix.

DISCUSSION

This study has attempted to integrate previously disparate and isolated measures and theories to find a cohesive description of achievement-relevant personality and situate it within the paradigmatic sphere of the Big Five. Although the individual measures used in this study may have been motivated from an investment, goal, or expectancy-value theoretical tradition, unifying characteristics of the scales will be important for codification and simplification of the APM field. Providing a comprehensive taxonomy of which traits or characteristics matter for academic success and how these relate to one another will allow researchers to focus efforts on developing successful interventions with an integrated set of trait terms and constructs. It is our hope that the preliminary conceptual map that has been presented in this study will allow for some level of cross-translation between studies conducted by differential or educational psychologists and stimulate discussion about combined future efforts. Further, the product of the large, multivariate nature of this study is that a reduced scale can be created that encompasses a large amount of the variance that was found in the original scales.

To review the findings of the current study, we found that the correlations among thirty-six commonly used scales of personality factors important for academic success could be well accounted for by five latent factors: performance goals, mastery goals, self-doubt, effort, and hungry mind. Each of these latent factors displayed some relation with well-established measures of broad, domain-general personality, primarily conscientiousness, neuroticism, and openness to experience. Mastery and effort were significantly associated with higher levels of conscientiousness. Neuroticism was associated with higher levels of the performance and effort factors as well as lower levels of the hungry mind factor. Finally, higher levels of openness to experience were associated with mastery, effort, and hungry mind. Interestingly, a clear divide emerged between the latent factors that were highly predicted by the Big Five and those that were not. Effort and hungry mind appear to be domains that are largely related with general measures of personality, whereas the domains of performance, mastery, and self-doubt are only weakly to moderately related. Moving to a higher fidelity analysis using facet-level

measurement, differential patterns of association were observed. The facets of self-discipline, anxiety, and ideas were consistently more strongly related to the APMs than their complimentary within-domain facets, order, depression, and aesthetics, respectively.

However, the most pragmatically important aspect of the initial study was refining and exploring the structural properties at the item-level to produce the MAPS. Using exploratory and confirmatory factor analysis we collected the ten items that represented the shared variance of each latent factor to the largest degree and constructed a reduced scale from these items. We were able to reduce the number of items required to assess the major achievement-relevant constructs by more than 80%. Although the reduced scale is derived from previously validated scales with highly face valid items, it was important that the psychometric properties of the new scale be replicated and validated in a separate sample before we could recommend their use. This was the goal of Study 2.

Table 2.1. Descriptive statistics of each APM divided into content areas

Variables	Mean	SD	Alpha
Approaches to Learning			
1. AGQ Performance Approach	4.75	1.58	.93
2. AGQ Performance Avoid	5.48	1.33	.71
3. AGQ Mastery Approach	5.62	1.08	.84
4. AGQ Mastery Avoid	4.83	1.41	.81
5. SPQ- Deep	4.36	.93	.80
6. SPQ- Surface	3.59	0.93	.79
7. PALS Performance Approach - Original	4.92	1.35	.88
8. PALS Performance Approach - Revised	3.91	1.52	.92
9. PALS Performance Avoid - Original	3.78	1.43	.88
10. PALS Performance Avoid - Revised	3.77	1.58	.90
11. PALS Mastery - Original	5.22	1.11	.85
12. PALS Mastery - Revised	5.73	1.00	.91
Effort			
13. Procrastination	3.97	.81	.76
14. FMPS - Mistakes	3.46	1.35	.91
15. FMPS - Standards	3.98	1.07	.70
16. FMPS - Parent Expectations	3.33	1.39	.82
17. FMPS - Parent Criticism	4.20	1.21	.66
18. FMPS - Doubts	4.98	1.19	.81
19. FMPS - Organization	4.91	1.47	.95
20. Achievement Striving	5.50	.95	.90
21. Motivation to Pursue Interests	5.30	.74	.89
Hungry Mind			
22. Tolerance for Ambiguity	4.05	.75	.83
23. Avoidance of Novelty	3.70	1.20	.87
24. Ingenuity	4.96	1.14	.90
25. Intellect	4.82	.94	.81
26. Quickness	5.00	.95	.87
27. Creativity	5.17	.97	.70
28. Depth	5.29	.99	.87
29. Love of Learning	4.82	.94	.81
Self and School Evaluations			
30. Self-Esteem	5.35	1.16	.92
31. Self-Efficacy	5.70	1.06	.85
32. Locus of Control	4.79	.64	.57
33. Academic Efficacy	5.46	1.13	.92
34. Avoidance of Achievement	2.49	1.11	.85
35. Skepticism about School	2.61	1.33	.89
36. Competence	5.09	.94	.86

Table 2.2. Descriptive statistics of the Big Five domains and facets

Variables	Mean	SD	Alpha
1. Extraversion	.74	9.21	.90
1a. Assertiveness	2.96	6.12	.85
1b. Activity	-1.66	2.36	.74
2. Agreeableness	8.73	8.47	.82
2a. Altruism	1.07	4.07	.68
2b. Compliance	5.37	3.23	.63
3. Conscientiousness	4.77	8.22	.82
3a. Order	3.52	2.67	.56
3b. Self-Discipline	2.61	4.94	.72
4. Neuroticism	-4.93	8.37	.83
4a. Anxiety	-.39	4.95	.80
4b. Depression	-4.32	2.44	.43
5. Openness to Experiences	1.47	8.56	.80
5a. Aesthetics	2.29	3.34	.55
5b. Ideas	.40	4.75	.71

Table 2.3. Standardized regression coefficients for each APM on the Big Five

Variables	E	A	C	N	O	R^2
Approaches to Learning						
1. AGQ Performance Approach	.03	.02	**.24***	**.29****	-.02	.11
2. AGQ Performance Avoid	.00	**.16**	-.05	**.27***	.06	.07
3. AGQ Mastery Approach	-.07	.05	**.25****	**.17**	**.29****	.16
4. AGQ Mastery Avoid	.12	-.03	**-.19***	**.40****	**.19***	.20
5. SPQ- Deep	.05	-.06	**.31****	.10	**.38****	.27
6. SPQ- Surface	.05	.00	**-.35****	**.17**	**-.15**	.22
7. PALS Performance Approach- Original	-.06	.01	.00	**.24***	.03	.06
8. PALS Performance Approach- Revised	-.04	-.09	-.05	**.21***	.02	.08
9. PALS Performance Avoid- Original	-.06	.08	-.10	**.29****	-.07	.13
10. PALS Performance Avoid- Revised	-.04	.14	-.05	**.34****	-.01	.12
11. PALS Mastery- Original	.01	.11	**.14**	-.01	**.39****	.23
12. PALS Mastery- Revised	-.03	.11	**.26****	.07	**.25****	.16
Effort						
13. Procrastination	-.01	.01	**-.65****	.01	.08	.45
14. FMPS - Mistakes	-.04	-.06	-.01	**.42****	.00	.22
15. FMPS - Standards	-.10	.02	**-.27****	**.28****	.14	.19
16. FMPS - Parent Expectations	-.04	**-.21***	-.10	.06	.14	.08
17. FMPS - Parent Criticism	-.07	-.04	.10	**.23***	**.21***	.09
18. FMPS - Doubts	-.07	-.01	**.37****	.11	**.25****	.21
19. FMPS - Organization	-.07	.01	**.64****	.09	.08	.41
20. Achievement Striving	**.11**	.02	**.61****	.09	**.19***	.48
21. Motivation to Pursue Interests	**.15***	-.09	**.24****	-.04	**.38****	.32
Hungry Mind						
22. Tolerance for Ambiguity	.06	-.07	-.09	**-.51****	**.24****	.38
23. Avoidance of Novelty	.01	**.15**	**-.18***	**.15**	**-.35****	.23
24. Ingenuity	**.18***	**-.13**	.09	-.07	**.65****	.59
25. Intellect	.02	**-.15**	.05	.01	**.62****	.40
26. Quickness	.02	**-.16***	**.23****	**-.19***	**.51****	.45
27. Creativity	-.04	.03	.08	**-.16***	**.65****	.53
28. Depth	-.10	.00	.02	.12	**.61****	.32
29. Love of Learning	-.04	-.07	**.26****	.09	**.46****	.29
Self and School Evaluations						
30. Self-Esteem	**.15**	.09	**.26****	**-.35****	.10	.40
31. Self-Efficacy	**.15**	.11	**.26****	**-.29****	.10	.36
32. Locus of Control	.03	-.05	**.37****	-.09	**.19***	.23
33. Academic Efficacy	.02	.05	**.29****	**-.19**	**.20***	.25
34. Avoidance of Achievement	-.10	.03	-.06	-.02	-.07	.02
35. Skepticism about School	-.13	-.14	**-.26****	-.05	.07	.11
36. Competence	**.14**	.03	**.57****	**-.12**	**.13**	.52

Table 2.3 (continued).

Note: Values printed in bold are significant at $p < .05$; * indicates values significant at $p < .01$; ** indicates values significant at $p < .001$.

Table 2.4. Factor structure of APM and variance explained.

Variables	F1 (Perf.)	F2 (Mast.)	F3 (Doubt)	F4 (Effort)	F5 (Mind)	R^2
Approaches to Learning						
1. AGQ Performance Approach	**.34**	-.19	**.38**	**.44**	.01	.44
2. AGQ Performance Avoid	.21	.23	.02	-.09	-.17	.10
3. AGQ Mastery Approach	.23	**.36**	.18	-.27	-.01	.25
4. AGQ Mastery Avoid	.05	**.56**	.22	.17	-.04	.47
5. SPQ- Deep	-.02	**.64**	.12	.19	.08	.63
6. SPQ- Surface	.22	**-.38**	.09	-.21	.09	.31
7. PALS Performance Approach- Original	**.50**	-.11	**.39**	.28	.07	.57
8. PALS Performance Approach- Revised	**.69**	-.08	.14	.10	.09	.56
9. PALS Performance Avoid- Original	**.89**	.14	-.01	-.10	-.03	.81
10. PALS Performance Avoid- Revised	**.96**	.16	-.05	.01	-.01	.88
11. PALS Mastery- Original	-.02	**.78**	-.15	-.05	.13	.67
12. PALS Mastery- Revised	.07	**.76**	-.07	.15	-.09	.63
Effort						
13. Procrastination	.12	-.19	-.01	**-.55**	.19	.40
14. FMPS - Mistakes	.24	-.07	**.71**	-.01	.02	.70
15. FMPS - Standards	.14	.01	**.47**	-.21	.17	.35
16. FMPS - Parent Expectations	-.02	-.13	**.47**	-.08	**.30**	.28
17. FMPS - Parent Criticism	.06	-.01	**.78**	.23	.24	.71
18. FMPS - Doubts	.03	.08	**.51**	**.53**	.17	.63
19. FMPS - Organization	-.02	.15	.13	**.56**	-.18	.37
20. Achievement Striving	-.02	.18	.06	**.77**	-.01	.74
21. Motivation to Pursue Interests	.04	.20	.13	.29	**.43**	.52
Hungry Mind						
22. Tolerance for Ambiguity	-.25	-.06	-.26	-.07	**.45**	.40
23. Avoidance of Novelty	.27	**-.42**	.05	.01	-.20	.41
24. Ingenuity	.00	.01	.03	.19	**.77**	.74
25. Intellect	-.01	.12	.03	.02	**.64**	.49
26. Quickness	-.06	.10	-.01	.24	**.59**	.60
27. Creativity	.02	.00	-.13	.22	**.62**	.55
28. Depth	.12	**.34**	.04	-.09	**.50**	.45
29. Love of Learning	-.15	**.59**	.08	.01	.20	.55
Self and School Evaluations						
30. Self-Esteem	.02	-.05	**-.63**	**.50**	.14	.76
31. Self-Efficacy	.03	-.06	**-.60**	**.54**	.16	.75
32. Locus of Control	-.05	.02	.09	**.56**	.15	.41
33. Academic Efficacy	.08	.12	-.07	**.44**	.23	.40
34. Avoidance of Achievement	-.02	-.06	.27	-.11	.05	.09
35. Skepticism about School	-.21	.00	.13	**-.49**	.19	.25
36. Competence	.00	.04	-.22	**.83**	.00	.80

Table 2.4 (continued).

Note: These values come from a model that included the Big Five. Values printed in bold indicate that the scale was included in the item-level analysis of that factor. Descriptive factor labels indicate performance, mastery, self-doubt, effort, and hungry mind latent factors.

Table 2.5. Factor intercorrelations and standardized regression coefficients for Big Five and facets

	F1 (Perf.)	F2 (Mast.)	F3 (Doubt)	F4 (Effort)	F5 (Mind)
Factor Correlations					
F1 (Perf.)	1.00				
F2 (Mast.)	-.04	1.00			
F3 (Doubt)	**.30****	.10	1.00		
F4 (Effort)	.15	**.30****	.09	1.00	
F5 (Mind)	.10	.16	.16	**.32****	1.00
Regression Coefficients for Big Five					
Extraversion	-.03	-.06	-.13	.11	.06
Agreeableness	.12	.05	.12	.04	**-.16***
Conscientiousness	-.12	**.28***	.04	**.71****	-.08
Neuroticism	**.34****	.15	**.43****	-.06	**.20***
Openness to Experience	-.10	**.46****	.06	**.13**	**.77****
Variance accounted for (R^2) by Big Five	.17	.30	.27	.65	.71
Regression Coefficients for Facets					
Assertiveness (E)	-.08	-.02	-.18	.13	.04
Activity (E)	.07	.00	.14	.00	-.01
Altruism (A)	.19	-.15	**-.22**	-.08	-.01
Compliance (A)	-..14	**.19**	-.02	.04	-.07
Order (C)	.07	-.01	-.04	**.26****	-.13
Self-Discipline (C)	**-.23**	**.32***	.05	**.47****	-.10
Anxiety (N)	**.29****	.10	**.38****	.09	**-.16**
Depression (N)	.01	.10	.08	**-.26****	-.06
Aesthetics (O)	.08	.13	.02	.00	**.16***
Ideas (O)	-.15	**.40****	.05	**.15**	**.70****
Variance accounted for (R^2) by Facets	.22	.35	.30	.66	.70

Note: The factor correlations and regression coefficients for the Big Five come from a model that included the Big Five. The facets were included in a separate model. Descriptive factor labels indicate performance, mastery, self-doubt, effort, and hungry mind latent factors. Values printed in bold are significant at $p < .05$; * indicates values significant at $p < .01$; ** indicates values significant at $p < .001$.

Table 2.6. Results of target rotated exploratory factor analysis of reduced scale items.

Item Number	Performance	Mastery	Self-Doubt	Effort	Hungry Mind
Performance (α = .934)					
1.	**.94**	.19	-.12	.00	.00
2.	**.78**	-.10	.09	.06	.15
3.	**.91**	.17	-.08	-.12	.18
4.	**.87**	.17	-.06	.09	-.10
5.	**.74**	-.04	.10	.07	.11
6.	**.77**	.01	-.04	.19	.03
7.	**.82**	.05	-.04	.04	-.01
8.	**.82**	.12	-.03	-.01	.02
9.	**.79**	.11	.01	-.07	.11
10.	**.64**	-.04	.13	.17	.15
Mastery (α = .904)					
11.	.00	**.79**	-.09	-.17	.11
12.	.02	**.72**	.07	-.05	.19
13.	.03	**.94**	-.06	.07	-.27
14.	.09	**.94**	-.09	-.05	-.14
15.	-.02	**.55**	.08	.08	.22
16.	-.01	**.46**	.15	.17	.18
17.	.00	**.54**	.13	.08	.19
18.	.07	**.68**	.14	.07	-.07
19.	.01	**.49**	.17	.05	.19
20.	.21	**-.60**	-.01	.17	-.06
Self-Doubt (α = .920)					
21.	-.07	.12	**.94**	-.10	.03
22.	-.12	.11	**.85**	-.15	.00
23.	-.10	.05	**.88**	-.06	.01
24.	.11	-.01	**-.68**	.18	.12
25.	-.08	.00	**.87**	.05	.04
26.	-.06	.04	**.78**	-.16	.05
27.	.19	-.05	**.75**	.19	.10
28.	.15	-.07	**.70**	.28	.01
29.	.27	.05	**.62**	.17	.09
30.	.23	.19	**.41**	-.11	.01
Effort (α = .904)					
31.	-.01	-.12	.13	**.93**	.06
32.	.01	.03	.04	**.86**	-.02
33.	.06	.18	.11	**.99**	-.33
34.	.01	-.03	.08	**.91**	-.07
35.	-.05	-.22	.08	**.95**	-.11
36.	.00	.09	.17	**.67**	.08

Table 2.6 (continued).

37.	.08	-.13	-.01	**.59**	.29
38.	.04	.08	.07	**.58**	.11
39.	.15	.15	-.10	**.38**	.15
40.	.00	.05	.14	**.79**	-.32
Hungry Mind (α = .902)					
41.	.05	.03	.06	-.14	**.90**
42.	.08	.14	.07	-.14	**.80**
43.	.11	.28	.08	.15	**.43**
44.	.07	-.12	.03	.09	**.80**
45.	.09	.09	.09	.15	**.53**
46.	.05	-.08	.10	-.20	**.95**
47.	.09	-.20	.02	-.17	**.99**
48.	-.10	-.03	.13	-.08	**.76**
49.	.01	.15	.18	.25	**.41**
50.	.04	-.07	.05	-.07	**.82**

Note. Values printed in bold are the highest value for the item.

Chapter 3: Study 2

METHOD

Participants

Participants were 359 students who voluntarily completed the study materials. These participants were sampled from a specific foundational psychology course at the same research institution in Texas. We collected self-report data on 359 students and course performance information from the complete population of the course (n = 490). Examining the course performance data, 13 students were missing data for each exam grade and were determined to have dropped the course. These individuals were dropped from all further analyses. Thus, we were able to sample 75.26% of the entire, eligible course population. Due to the relative brevity of the instrument used in this study, validation items were not included in the self-report materials, and we did not remove any additional participants from the analysis. The majority of the students were female (n = 214; 59%). The age range of the sample was wide with a minimum age of 17 and a maximum age of 43. The mean age was 19.5 years old with 92% of the sample under 21 years of age. The sample was similarly diverse in terms of the racial and ethnic composition, in that the sample contained non-Hispanic White (n = 238, 66.3%), Hispanic (n = 83, 23.1%), Asian (n = 47, 13.1%), and Black (n = 29, 8.1%) participants. Additionally, one participant selected American Indian or Pacific Islander and 43 (12.0%) selected Other race/ethnicity.

Measures

The primary measure under investigation was the MAPS established in Study 1. See the Appendix for complete item content and scoring procedure for this scale. We sought to replicate or test the associations between the MAPS and three classes of constructs: self-reported demographics, personality traits, and objective indices of academic performance. First, we included the demographic characteristics of age, gender, and socioeconomic status to control for their influences on academic achievement. Age was recorded in years. Gender was recorded as 0

for male participants and 1 for female participants. Socioeconomic status was computed with three indicators: paternal educational attainment, maternal educational attainment, and the log of family income. These were standardized and averaged to produce a socioeconomic status composite.

Second, we included common, broad measures of personality to replicate the previous findings and test the ability of the MAPS to add incremental prediction. Due to a desire to restrict the materials to a relatively short length, we used the Ten Item Personality Inventory to assess the Big Five rather than a lengthier scale (TIPI; Gosling, Rentfrow, & Swann, 2003). This scale produces broad domain scores for extraversion, agreeableness, conscientiousness, neuroticism, and openness to experience, but not for more narrow facets.

Finally, we obtained percent correct quiz grade, percent responded class participation grade, and the percent correct on three exams associated with the specific foundational psychology course in which all participants were enrolled to validate the MAPS. Each of these indicators of achievement may be thought of as requiring different cognitive or motivational factors. Class participation simply required attending the course and using a remote electronic device to respond to multiple choice questions during the lecture; participation grade represents the percent of questions responded to regardless of the correctness of the answer. In this case, motivational constructs are likely to be important. Exam grades, on the other hand, are limited by time constraints, have important outcomes and require accurate knowledge of material. Actual studying or learning behaviors may be more relevant. Quiz grades lay intermediately between these two extremes and may require a more complex blend of traits. Quizzes were frequently administered (twice weekly), and students were allowed to use their textbooks, notes, and Internet resources to answer quiz questions. Thus quizzes may tap both motivational constructs (i.e., consistent willingness to complete a recurring assignment over the course of a semester) and accurate knowledge, but did not require long-term retention or studying.

The course measures have some strengths and weaknesses that are important to point out. A primary strength is that we were able to obtain data on every individual in the sampled

population directly from course records. Therefore, we do not have any missing data for the primary dependent variables. Complete data also allows for the comparison of responders and non-responders. This analysis is not typically performed in many research studies because measured psychological outcomes are difficult to obtain without participation. Additionally, the subject content and test material was the same for every individual, and therefore, we do not conflate course performance with course difficulty (Berry & Sackett, 2009). However, course-specific indices of performance may be less generalizable due to idiosyncratic interactions between the person and course specific content. Typical measures of academic performance (e.g., GPA) cover a wider, albeit self-selected, range of learning situations. Because we were also interested in more generalized academic performance, we obtained self-reported college GPA. This was reported as a continuous measure on a four-point scale. One individual reported a GPA of 4.5 which we replaced with the value of 4.0. Removing or including this participant's data did not substantively affect the results.

Procedure

The participants were informed during lecture and via email that the materials were available to be completed with the REDCap system (Harris et al., 2009). The participants completed the materials during their free time in a place of their choosing and did not receive any class credit for completing the instrument. The participation experience was used to complement the lecture material and familiarize the students with scale formats. At the conclusion of the semester, the indicators of academic performance were obtained from the instructor.

Analytic Approach

The first task of analyzing the data obtained from Study 2 was to compare those who responded to the MAPS with those who did not. This provides an estimate of possible selection effects on the sample. We tested if the variance and mean for responders compared to non-responders was different for the course-specific academic outcomes.

Following this, we conducted a preliminary EFA to evaluate the factor structure of the MAPS and created scale scores based on these results. To parallel the previous analysis, we first examined the MAPS-Big Five associations. Next, we estimated the pairwise associations between our predictors (demographics, MAPS, and Big Five) and the achievement outcomes with zero-order correlation coefficients. Then, we proceeded to analyze four regression models predicting academic achievement: demographics alone, MAPS alone, Big Five alone, and all constructs. This allowed for a full examination of the variance that is shared with achievement, as well as, possible overlap in shared variance among different domains. Descriptive statistics of the finalized scales are presented.

All models were fit using full-information maximum-likelihood estimation in M*plus* statistical software (Muthén & Muthén, 1998-2010).

RESULTS

Sample Selection Effects

A Levene test of homogeneity of variance indicated that there were significantly different amounts of variance between responders and non-responders for the quiz grade (*SD* of 10.45 compared to 17.36, $p < .001$), participation grade (*SD* of 22.23 compared to 30.97, $p < .001$) and exam grade (*SD* of 10.59 compared to 13.17, $p < .01$) variables. As such, equal variances were not assumed, and *t*-tests were conducted. Responders performed significantly better in terms of quiz ($t[147.46] = 2.42$, $p < .05$), participation ($t[160.35] = 6.07$, $p < .001$) and exam grades ($t[171.59] = 4.72$, $p < .001$). Overall, the mean group differences were moderate in size for quiz (88.28 vs. 92.34), participation (68.33 vs. 86.99), and exam (71.64 vs. 77.92) grades. While we were able to sample a large majority (75%) of the total population, it is important to note that the relations between the MAPS and our indices of academic performance may be attenuated due to a restriction of the range of the academic indicators.

Factor Structure Replication

The scree plot of an oblique, geomin rotated EFA indicated a five factor solution was reasonable. Based on this and our expectation of a five factor structure, we explored this solution. The factor loadings and factor correlations from the five factor solution are presented in Table 7. The structure of the scale is largely replicated. Column congruence coefficients were calculated to compare the factor structure presented in Table 6 with that presented in Table 7. Across two samples, the congruence of the factor structure was high with coefficients ranging from .74 to .93. Of the 50 items, only two items did not load most strongly on the expected factor. This was the case for one item from the effort domain and one item from the hungry mind domain. These two items were dropped from further analysis. Moderate intercorrelations were found among the factors. We computed scale scores as the mean of the items within a domain. Descriptive statistics for the scale scores and other measures are presented in Table 8. Reliability estimates were all high for the final scales assessing performance (α = .86), mastery (α = .88), self-doubt (α = .90), effort (α = .84) and hungry mind (α = .82).

MAPS-Big Five Associations Replication

The MAPS were then predicted by the Big Five. The standardized regression coefficients from this analysis are presented in Table 9. The majority of the results are similar to those found in the previous analysis. Mastery was significantly predicted by higher levels of conscientiousness and openness. A large, positive effect was found for neuroticism predicting self-doubt. A similar strong association was found between effort and conscientiousness and a weaker relation was found with openness. Hungry mind was predominantly associated with openness, but it retained less substantial relations in the expected direction with agreeableness. Each of these results replicates earlier findings. Additionally, the general trend of performance and mastery having less variance in common with the Big Five and effort and hungry mind constructs having more common variance was replicated. However, there were some divergent findings. Performance, originally significantly predicted by higher levels of neuroticism, was

found to be unrelated to neuroticism and significantly associated with higher levels of conscientiousness and lower levels of agreeableness. In Study 1, self-doubt was largely unrelated to broad personality domains, but in Study 2 the variance accounted for increased by 12% to share similar amounts of variance as effort and hungry mind. The remaining changes were primarily in regards to smaller magnitude coefficients.

Two sources are likely to explain the majority of the differences between Study 1 and Study 2. First, Study 2 included nearly twice as many participants as Study 1 meaning that trends that were marginal in Study 1 appear significant in Study 2. For example, the performance construct shared almost no variance with the Big Five, and therefore, the larger sample size allowed for very weak coefficients to be statistically significant. Their pragmatic significance is likely very small. Second, we used a very brief measure of the Big Five that may sample slightly different item content. It is unclear if the results are due to the different instruments used to assess the Big Five or a lack of replication for the MAPS. However, despite these minor discrepancies, there were strong similarities between the results of Study 1 and Study 2. For coefficients that are significant in both samples, all except the relatively small coefficient for neuroticism predicting hungry mind are in the same direction, and nearly 80% of the associations found in Study 1 were replicated.

MAPS-Achievement Validation

The primary focus of Study 2 was to validate the MAPS with both course-specific and self-report measures of academic achievement. Table 10 reports the zero-order correlations of each predictor variable with the course-specific academic outcomes and the results of four regression models that were used to predict each academic indicator separately. Focusing on the zero-order correlations, effort consistently had a moderate and positive association with all three academic outcomes. Performance, while slightly weaker, was also positively associated with each outcome. Participation and exam grades were more strongly associated with mastery than

performance, but mastery was unrelated to quiz grades. Hungry mind was only positively associated with exam grades. Self-doubt was uncorrelated with any of the outcomes.

Turning to the domains of demographics and the Big Five, some consistent results are found. Older participants and men tended to perform somewhat worse, and students from higher socioeconomic status backgrounds tended to perform better on exams but not the other outcomes. Higher levels of extraversion, neuroticism and openness were associated with lower quiz achievement. More agreeable students tended to participate in class more as evidenced by the significant correlation with participation grade. Similar to effort, conscientiousness was significantly correlated with each achievement outcome positively and to a moderate degree. We now turn to regression analyses to determine if the predictive utility of each of the variables is common or unique of the other variables.

We ran three separate models to determine the within-domain overlap among variables in the prediction of achievement. In models that included all demographic variables, the results from the zero-order correlations are largely unchanged, indicating that much of the variance that is associated with achievement among these variables is unique of other demographic factors. A similar pattern is largely observed with a model that includes all of the Big Five personality factors. Conscientiousness remains the primary variable of importance with smaller, negative associations found for neuroticism and openness in the prediction of quiz grades.

The results for the MAPS constructs differ slightly depending on the outcome. For quiz grades, the effect size of effort increases substantially and hungry mind becomes a significant, negative predictor when the other constructs are controlled. This is indicative of a contrast or suppression effect. Given that the remaining MAPS factors are not significantly related to quiz grades, the most likely interpretation of this result is that, holding the level of effort given to studying constant, a student with a higher level of hungry mind will tend to perform worse on quizzes. This is not born out at the zero-order level for hungry mind because those who possess a hungry mind also tend to possess a high level of effort (r = .39) which multivariate approaches take into account. Moving to participation grade, a similar suppression effect is found between

effort and hungry mind. Interestingly, mastery, which possessed significant zero-order correlations with participation and exam grades, did not significantly predict achievement when other factors were controlled. Similarly, performance was significantly correlated with each measure of achievement, but it only retained its significant relation with exam grades. However, performance was the only predictor out of four significant zero-order correlations that remained statistically significant in the prediction of exam grades indicating that much of the predictive variance is shared among the other constructs. Finally, each domain accounted for a modest proportion of variance in the achievement outcomes. For demographics this ranged from .02 to .08. Variance accounted for by the MAPS ranged from .08 to .12, and it ranged from .05 to .14 for the Big Five.

The final model of interest for the course-specific achievement outcomes included every predictor. Importantly, both effort and conscientiousness remain significant predictors of quiz and participation grades indicating that there is incremental predictive validity of the two constructs. The coefficients were somewhat attenuated compared to previous models. This was to be expected due to the fact that conscientiousness was a significant predictor of effort. Other interesting results include the significantly negative coefficients of neuroticism and openness predicting quiz grades. Turning to participation grades, however, higher levels of openness are associated with better achievement. The full model results for exam grades are somewhat surprising in that extraversion was the only significant personality trait to predict the outcome even though it did not have a significant association in any of the previous models. Overall, demographics, MAPS constructs, and broad personality traits together accounted for nearly a fifth of the variance in the course-specific achievement measures.

To examine the ability of these constructs to predict domain-general achievement rather than course-specific achievement, we examined college GPA. The results are presented in Table 11. College GPA had significant zero-order associations with socioeconomic status, each construct of MAPS and conscientiousness. In both the full and within demographics models, higher socioeconomic status students tended to report higher GPAs. Controlling for the other

MAPS, only higher levels of performance orientation and effort significantly predicted college GPA. Conscientiousness retained its positive association with GPA when controlling for the other Big Five traits, but it did not in the final model. The final model indicates a special position for the academically contextualized effort domain in that it was the only personality trait that remains significantly predictive. Again, nearly a fifth of the variance in college GPA is accounted for in the final model. The combined results demonstrate the importance of demographics, APMs and the Big Five depending on the outcome of interest.

DISCUSSION

The purpose of Study 2 was to replicate and validate the novel, reduced scale format that assesses the dimensions of performance, mastery, self-doubt, effort, and hungry mind. The psychometric properties of the MAPS were found to be strong. Out of 50 possible items, only two did not load most strongly on the intended factor in an EFA, and the reliability of the scales and the congruence coefficients between two samples were uniformly high. Although some of the MAPS-Big Five associations changed slightly, the primary results remained largely the same. Replicated associations include those between mastery and conscientiousness and openness, self-doubt and neuroticism, effort and conscientiousness and openness, and finally, hungry mind and (lower) agreeableness and openness. Additionally, the four achievement outcomes that likely assess different aspects of what is required to succeed academically were all significantly predicted by the MAPS domains. Effort was the most significant and consistent predictor of achievement. This construct had significant zero-order correlations with most of the academic outcomes (*r*'s ranging from .23 to .33). Performance orientation also tended to be associated with achievement at the zero-order level, but this relation was significantly attenuated when controlling for demographics and the Big Five. In contrast, effort maintained sizable coefficients when other predictors were include in the model. This indicates that variance in important, complex outcomes like academic achievement can be explained by personality traits outside the common Big Five framework.

Table 3.1. Factor loadings, congruence coefficients and factor correlations from five factor EFA of the MAPS.

Item Number	Performance	Mastery	Self-Doubt	Effort	Hungry Mind
Performance					
1.	**.55**	.09	-.07	.03	.00
2.	**.67**	.00	-.04	-.09	-.02
3.	**.64**	-.07	.05	.04	.04
4.	**.55**	-.05	.09	-.10	.07
5.	**.84**	-.01	-.09	-.07	.02
6.	**.67**	.15	-.06	.09	-.05
7.	**.43**	.05	.04	.05	.10
8.	**.52**	-.05	.25	-.01	-.10
9.	**.62**	-.05	.11	.00	-.02
10.	**.64**	.10	.04	.07	.16
Mastery					
11.	.02	**.69**	-.08	-.15	-.03
12.	-.10	**.58**	.07	.14	.12
13.	.01	**.82**	.03	.02	.01
14.	.10	**.74**	-.09	-.01	-.01
15.	.06	**.40**	.00	.17	.34
16.	.10	**.66**	-.01	.11	-.02
17.	-.03	**.61**	.05	.04	.19
18.	-.03	**.73**	.03	.15	-.06
19.	.03	**.60**	.00	-.08	.03
20.	-.10	**.58**	-.10	-.21	.09
Self-Doubt					
21.	-.02	-.03	**.78**	.00	-.01
22.	-.02	.04	**.68**	-.20	-.04
23.	-.02	.07	**.78**	-.22	.04
24.	.00	-.10	**.65**	-.14	-.09
25.	.05	.11	**.74**	-.03	-.02
26.	-.02	-.02	**.76**	.02	-.06
27.	.41	-.02	**.51**	-.01	-.02
28.	.33	-.09	**.53**	.09	.08
29.	.39	.09	**.38**	-.04	-.02
30.	.09	-.03	**.48**	-.02	-.12
Effort					
31.	.09	.13	-.20	**.51**	-.04
32.	.08	.16	-.02	**.37**	.31
33.	.02	.12	-.03	**.65**	.05
34.	-.03	-.05	-.09	**.65**	.23

Table 3.1 (continued).

35.	-.01	-.14	-.14	**.52**	.20
36.	.00	.03	-.03	**.61**	.12
37.	-.02	.15	-.28	**.44**	-.02
38.	-.02	.13	.10	**.55**	-.01
39.	.00	**.37**	-.20	-.02	.22
40.	.05	.14	-.01	**.46**	-.06
Hungry Mind					
41.	.04	-.01	.01	-.11	**.86**
42.	-.05	.16	.13	.03	**.66**
43.	-.07	**.42**	.02	.22	.20
44.	.06	-.03	-.06	.12	**.78**
45.	-.10	.20	-.02	.17	**.38**
46.	.07	.11	-.09	.05	**.28**
47.	.01	-.02	-.14	-.19	**.81**
48.	-.04	.13	-.07	.12	**.17**
49.	.05	.22	-.07	.10	**.27**
50.	-.04	.07	.02	-.02	**.74**
CCC	.93	.78	.74	.88	.84
Factor Correlations					
Performance	1.00				
Mastery	.00	1.00			
Self-Doubt	.12	-.18	1.00		
Effort	.11	.48	-.40	1.00	
Hungry Mind	.04	.38	-.39	.37	1.00

Note. Factor loadings printed in bold indicate the item's highest loading. Item numbers printed in bold indicate that the item did not load highest on the expected factor, and were therefore excluded from the final scale. CCC stands for the column congruence coefficient which calculates the agreement between the columns in Tables 6 and 7.

Table 3.2. Descriptive statistics of measures used in Study 2

Variable	*n*	Mean	SD
Age	371	19.51	2.27
Gender	362	.59	.49
Socioeconomic Status	402	.00	.92
Performance	360	-.20	1.13
Mastery	359	1.42	.95
Self-Doubt	359	-1.15	1.22
Effort	359	1.24	.97
Hungry Mind	357	1.44	.90
Extraversion	352	4.48	1.61
Agreeableness	352	4.93	1.19
Conscientiousness	352	5.56	1.21
Neuroticism	351	3.10	1.38
Openness	351	5.52	1.19
Quiz Grade	490	90.21	12.58
Participation Grade	490	80.50	28.23
Exam Grade	477	76.36	11.60
College GPA	343	3.12	.65

Table 3.3. Standardized regression coefficients for the MAPS constructs on the Big Five

Predictors	Performance	Mastery	Self-Doubt	Effort	Hungry Mind
Extraversion	.05	.02	**-.23****	**.15****	**.12**
Agreeableness	**-.13**	.02	-.01	.01	**-.13***
Conscientiousness	**.12**	**.29****	**-.16****	**.62****	**.12***
Neuroticism	.09	-.01	**.46****	-.07	**-.13***
Openness	-.07	**.25****	-.07	**.16****	**.50****
R^2	.04	.18	.39	.51	.38

Note. Values printed in bold are significant at $p < .05$; * indicates values significant at $p < .01$; ** indicates values significant at $p < .001$.

Table 3.4. Zero-order correlations and standardized regression coefficients for the prediction of course-specific academic outcomes

Predictors	Quiz Grade					Participation Grade					Exam Grade				
Demographics	(0)	(1)	(2)	(3)	(4)	(0)	(1)	(2)	(3)	(4)	(0)	(1)	(2)	(3)	(4)
Age	**-.13**	**-.12**			**-.11**	-.07	-.05			-.07	-.08	-.03			-.05
Gender	.07	.06			.04	**.13**	**.13**			.08	**.12**	**.11**			.09
SES	.05	.05			.07	.09	**.11**			**.14***	**.23****	**.26****			**.27****
MAPS															
Performance	**.13**		.11		.03	**.11**		.06		-.03	**.17***		**.17***		.05
Mastery	.04		-.07		-.06	**.22****		.12		**.13**	**.18****		.10		.12
Self-Doubt	-.06		-.01		.11	-.06		.05		.10	-.10		-.06		-.01
Effort	**.25****		**.38****		**.27***	**.30****		**.32****		**.17**	**.23****		.14		.10
Hungry Mind	-.03		**-.20***		-.06	.09		**-.13**		.04	**.13**		-.03		.03
Big Five															
Extraversion	**-.11**			-.08	-.11	-.04			-.01	-.05	-.06			-.10	**-.18***
Agreeableness	.08			-.01	-.01	**.11**			.04	.03	.01			.00	-.04
Conscientiousness	**.30****			**.29****	**.15**	**.32****			**.32****	**.18***	**.18***			**.17***	.06
Neuroticism	**-.17****			**-.15***	**-.20***	-.07			-.01	-.05	-.09			-.07	-.08
Openness	**-.12**			**-.15***	**-.14**	-.05			-.09	**.17***	.05			.07	.02
R^2		.02	.11	.14	.19		.03	.12	.11	.18		.08	.08	.05	.17

Note. SES stands for socioeconomic status. The column labeled 0 presents zero-order correlations. The columns labeled 1-3 present within domain regressions for demographics, MAPS, and the Big Five separately. Column 4 presents a combined model that includes all predictors. Values printed in bold are significant at $p < .05$; * indicates values significant at $p < .01$; ** indicates values significant at $p < .001$.

Table 3.5. Zero-order correlations and standardized regression coefficients for the prediction of self-report college GPA

Predictors	College GPA				
Demographics	(0)	(1)	(2)	(3)	(4)
Age	.02	.06			.05
Gender	.09	.09			.02
SES	**.20****	**.21****			**.20****
MAPS					
Performance	**.13**		**.14**		.06
Mastery	**.22****		.10		.12
Self-Doubt	**-.16***		-.10		-.05
Effort	**.33****		**.28**		**.32***
Hungry Mind	**.13**		-.12		-.08
Big Five					
Extraversion	.10			**.13**	.04
Agreeableness	.03			-.03	-.04
Conscientiousness	**.21****			**.22****	-.01
Neuroticism	-.06			-.02	.01
Openness	.03			-.06	-.10
R^2		.05	.14	.06	.18

Note. SES stands for socioeconomic status. The column labeled 0 presents zero-order correlations. The columns labeled 1-3 present within domain regressions for demographics, MAPS, and the Big Five separately. Column 4 presents a combined model that includes all predictors. Values printed in bold are significant at $p < .05$; * indicates values significant at $p < .01$; ** indicates values significant at $p < .001$.

Chapter 4: General Discussion

In these two studies, we have attempted to shed some light on the relations among APMs, the items that compose these scales, and their associations with the Big Five personality traits and academic achievement. We constructed a novel measure, the MAPS, assessing a wide range of personality factors that is both efficient and predictive of academic achievement. The major message of the empirical results is that academically contextualized orientations, traits, or habits share significant amounts of variance with traditional, broad personality traits. This links the educational and differential literatures in their interest in understanding how individual differences in trait-like constructs lead to disparities in achievement. However, a substantial amount of variance in the academically relevant personality measures was not shared with typical personality traits. Although there was modest overlap with the Big Five for some constructs like effort, the MAPS factors were not fully explained by personality traits, and this unique variance incrementally predicted academic outcomes over and above demographics and the Big Five. Researchers interested in the relation between individual differences and achievement should not focus exclusively on the Big Five or domain-general traits. Indeed, future work has the potential to be greatly advanced by using the theoretically rich literature of educational psychology in combination with the rigorous psychometric strengths of differential psychology. The results of the current study can be used both as a legend to place existing APMs in the context of the Big Five or other APMs and as possible starting place for more work to unify the measurement of these important constructs.

To reiterate the present findings, we performed factor analytic and regression analyses to explore the covariance structure of 36 scales with 268 items thought to be

related to academic success. The item content of the scales was refined to produce the Multidimensional Achievement-Relevant Personality Scale (MAPS), a brief measure (48 items) of five achievement-relevant factors: performance, mastery, self-doubt, effort and hungry mind. The internal psychometric properties of MAPS factors were strong and replicated across two samples. We placed the original scales, latent factors derived from them, and the novel measure in the context of the Big Five traits. Describing the results that replicated across both studies, performance orientation was largely unrelated to the Big Five. Mastery orientation displayed significant, positive associations with conscientiousness and openness across two samples, but the Big Five did not explain a large portion of the variance. Self-doubt was strongly associated with higher levels of neuroticism. Effort was highly related to conscientiousness and weakly with openness. Hungry mind displayed many small associations with the Big Five, but it retained a primary relation with openness. We also found evidence of the practical utility of the MAPS in terms of predicting academic achievement. Each domain of the reduced scale was found to be correlated with college GPA, and evidence of incremental prediction above the Big Five was found for some domains, particularly effort. On the whole, this is strong initial evidence for the utility of the brief scale for research purposes. Individual differences in motivation, beliefs, traits, and habits measured by the MAPS all have an influence on achievement.

COMPARISON OF NOVEL AND ORIGINAL SCALES

We have presented evidence of the consistency and validity of a novel measure that is both brief and broad. This scale does deviate from the original scales in some important ways. Beginning with the domain of approaches to learning, past research has indicated that approach-avoid versions of the performance and mastery domains have

discriminant validity (Elliot & McGregor, 2001; Huang, 2012), but the current results are somewhat mixed. Discriminant mastery and performance factors did emerge, but the approach and avoid distinction was largely unimportant in the current context. This is somewhat consistent with previous research. Many operationalizations of mastery goal orientation do not include an avoidance construct (such as the PALS). Additionally, the performance approach-performance avoid correlation was the strongest among approaches to learning constructs in Hulleman et al.'s (2010) meta-analysis. It is noteworthy that the AGQ performance-avoid scale did not load substantially on any factor in our preliminary analyses. The variance associated with the scale is not shared with any of the other measures, indicating its discriminant validity. Our goal was to reduce complexity and provide a streamlined measurement approach rather than incorporate every distinction that is potentially important. Further, the SPQ deep and surface scales both converged with the other mastery scales, but their loadings were in opposite directions. Mastery and performance manifested as distinct dimensions, but deep and surface study processes appear to be two ends of the mastery continuum. This may indicate that operationalizations using the mastery and performance distinction may cover a greater amount of the possible item content, particularly that which is specific to each factor. Theoretically, deep and surface study processes tap into how people study, and goal orientations tap into why people study. Differences in how people study may relate strongly to whether they are high or low in terms of their mastery orientation.

Overlapping content was found for the domains of effort, hungry mind, and self and school evaluations. The extracted effort factor included variables related to behavioral tendencies to complete tasks and more cognitively oriented assessments of effort related to the hungry mind domain. The self-doubt factor included perfectionistic scales as well as other academic evaluations. Finally, the hungry mind factor was

primarily composed of variables that were *a priori* assigned to the hungry mind domain. This is in line with assertions by Mussel (2010) that the individual indicators of this construct are highly unified.

SCALE REPLICATION AND VALIDATION

We will first address differential MAPS-Big Five associations found between the two studies. The most obvious source of divergence is that a different measure of the Big Five was used in each study. This decision was made to accommodate the time constraints of the participants and may have introduced noise due to the TIPI, as a very brief measure of the Big Five, not fully encompassing the range of content that is assessed by the Big Five Inventory. However, this is only a minor concern. In fact, replication across *both* measures and samples is more convincing than mere replication across samples (Lykken, 1968). The majority of results were replicated, with deviations primarily among relatively small coefficients that may have crossed the arbitrary significance threshold between studies due to increased sample size. Overall, we interpret the results as largely in favor of replication.

Interpretation of the results of Study 2 must incorporate the potential selection effects that occurred when recruiting this sample. The first sample was recruited as part of a general research requirement for introductory psychology courses. This means that a roughly random sample of everyone in this population would participate in the study or other studies that provided research hours. The second study relied on students within a single introductory psychology course to use their free time to complete the materials with no concrete academic requirement or reward. Although we were able to test for group differences between responders and non-responders in terms of achievement, we were unable to test this for the self-report variables. The responders tended to obtain

better objective grades within the course and display significantly less variance. It is an empirical question as to whether the responders and non-responders also differed in terms of their personality traits. Because the full range of achievement scores and trait variation was likely not sampled in Study 2, true associations may have been attenuated and hence nonsignificant. If we did not sample the lower end of the distribution, it reduces the power to find significant effects. It is unclear if the largely nonsignificant results for performance, self-doubt, and hungry mind might be due to the selection effect. It is conceivable that these traits may have a nonlinear association with achievement such that the majority of the influence is found at lower levels of achievement which would present additional problems for the current sampling approach. In spite of these selections issues, it is important to highlight that we were successful in obtaining self-report data from 75% of the course population, and the sample included a moderate amount of individuals who earned marks below a C- level (n = 43, 11.98%).

THEORETICAL ISSUES AND IMPLICATIONS

Before making strong conclusions about theoretical issues, we would highlight again the measurement uncertainty that has existed in this area of research for quite some time. We second the sentiment expressed by Hulleman et al. (2010) that theoretical progress can be best advanced by first settling measurement issues Building on previous efforts to conceptually organize a multitude of APMs (e.g. Richardson et al., 2012), we have attempted to use multivariate, empirical methods to continue the process of creating a consistent measurement paradigm for achievement-relevant personality.

Our finding that performance orientation is positively associated with achievement at the zero-order level in several domains is somewhat controversial. Many researchers (e.g. Midgley, Kaplan, & Middleton, 2001) claim that mastery approaches to

learning are the only adaptive construct that interventions should be based on. Instructing students to base their motivation on extrinsic rewards such as grades and social comparisons is argued to have the harmful side-effect of instilling a fragile sense of self-esteem or fostering poor social development. Other researchers (e.g., Harackiewicz, Barron, & Elliot, 1998) argue that performance goals can be adaptive in certain context such as highly competitive or rewarding situations. This may prepare students for an understanding of how labor markets work and teaches them that academic *achievement* is intrinsically important. It is clear that education and succeeding in the current academic system is highly important for significant life outcomes (Montez, Hummer, Hayward, Woo, & Rogers, 2011). Although we are not prepared to make claims about the social or health effects of one strategy or another, it is important to note that the course-specific measures of academic achievement that we obtained were from an introductory level psychology course that primarily enrolls freshmen. The requirements of other courses may reflect the skills or techniques associated with mastery to a greater degree. For instance, two of our measures, participation and quiz grades, primarily rely on skills that may be more closely aligned with being motivated by grades. Mastery was more strongly associated with overall college GPA which may indicate that this construct can be applied to a wider range of course content. A closer analysis of the exact behavioral requirements of various measures of academic achievement would likely clarify some of the differential patterns of association.

One controversy that remains in the approaches to learning literature is whether these constructs can reasonably be consider as traits or if they are entirely dependent on the academic context (Elliot & Thrash, 2002; Kaplan & Maehr, 2007). We have chosen to conceptualize the constructs as personality or individual differences that describe general tendencies across all academic endeavors. The second option would rely on goal

orientations in the context of a specific course or assignment, and the goal orientation is likely to change depending on course content, instruction style, or grade requirements. Although this possibility may be useful, we would argue that there are overarching dispositions or habits that are at play that can predict significant amounts of variance in academic outcomes as seen in the current study.

STRENGTHS AND LIMITATIONS

This article is the first to incorporate many overlapping measures of individual differences that are thought to influence the education process for the purpose of evaluating the underlying relations among specific scales and the higher-order constructs they assess. This process is important scientifically to advance the understanding of what scale scores actually mean and how to interpret them when used in a study. However, there are a few limitations that must be noted about the interpretation of the results. First, the current studies were specifically concerned with the factor structure and correlates of achievement-relevant personality in university students. The university years compose an extremely valuable period to study in its own right, given that college performance serves as a gatekeeper for occupational and financial success in modern economies. However, many researchers are specifically interested in achievement processes in earlier periods of education and development. The extent to which the current findings would generalize to students in grades K-12 is unclear. Empirical research across the entire range of child and adolescent development will of course be key to understanding the dynamic processes underlying personality development and the mechanisms underlying the personality-achievement interface.

A second limitation may be found in the choice of variables that were administered in the current study. There are a large number of scales that have been put

forward as related to achievement, and it was impossible to include all of them in a single study or paper. Our strategy was to gather as many of the most prevalent instruments in use or instruments that are representative of important theories or research areas. To stay within the reasonable limits of what we could expect the participants to accurately complete, some important research areas were omitted. Richardson et al. (2012) provide an excellent, comprehensive list of individual difference domains thought to be relevant for achievement, and Hulleman et al. (2010) provide a detailed list of approaches to learning scales. Additionally, Wigfield and Cambria (2010) provide a list motivated more by the educational psychology tradition. Although the current study was able to consolidate many scales included in these lists, there are certainly more that are in need of integration. The current results act as a starting point to begin evaluating more measures. Related to this point, some may criticize reducing 36 scales with substantial nuance and complexity to only five factors. For example, we did not produce approach and avoidance dimensions of the approaches to learning construct. Determining the proper number of factors to extract from an EFA requires some level of subjectivity. We desired to reduce and simplify the content as much as possible to fulfill the aim of creating efficient and precise measures.

FUTURE DIRECTIONS

Intelligence or ability is one further construct that was omitted from the current study that plays an integral part in academic achievement. As mentioned before, it is well-known that intelligence is a powerful predictor of academic achievement (Chamorro-Premuzic & Furnham, 2006). The complex, interactive nature of personality, the school environment, and intelligence in producing academic achievement is much less established. Exploring the relations between typical performance in terms of

personality, maximal performance in terms of intelligence, and the consequential outcome of academic achievement is a vital research endeavor.

We have introduced and validated a new scale. However, as with all new scales, a more complete understanding of its psychometric properties, patterns of associations, and generalizability across samples and age ranges will necessitate future empirical use in independent samples. MAPS greatly reduces the complexity of extant APMs, while at the same time removing some of the nuance that was found with measures within a domain. Testing whether or not previous, more differentiated scales can predict additional variance above and beyond the broad domain scales that were created in the current study will be an important step. For example, does knowing a participant's level of depth and ingenuity, components of hungry mind, provide more predictive power than simply knowing the score on the hungry mind scale? Pragmatically, does the increment in prediction outweigh the cost of adding items to a study design? We encourage researchers working in this area to address these questions in their ongoing work.

CONCLUSION

While there are many areas not covered in the current study, this should indicate the promise of research in the area of the personality-intelligence-achievement interface. Clearly, this is an important topic to understand that has a large amount of individual and social influence on the outcome. As such, it will take the combined efforts of researchers to synthesize the currently disperse and somewhat fragmented nature of the investigation. One goal of this project was to reduce the noisy number of different APMs so that a single study can efficiently cover the full taxonomy of general personality factors, achievement-relevant personality factors, intelligence and actual achievement efficiently to explore the dynamic, multivariate nature of these variables without being relegated to

using an untenably long collection of instruments. This study offers a potential starting off point for an effort to synthesize the central personality influences that play a role in the development of social and intellectual skills that take place during the educational process.

Appendix

For item content and the source of each item, see Table A1. To score the MAPS, first calculate the acquiescence index. This is accomplished by taking the average of items 1, 2, 5, 7, 11, 18, 21, 23, 31, 34, 35, 37, 41, 45, 47, 49 for every participant. Then, subtract this number from each item. Multiply reverse coded items by -1 to place it on the proper metric. An example SPSS script follows that assumes the naming structure of "APM_" and the number associated with the item in Table A1. Note that under this naming procedure no variable will be labeled "APM_39" or "APM_43," and these variables are not included in the sum score code for the effort or hungry mind scales.

```
*Compute the acquiescence index (acqindex).
COMPUTE acqindex = mean(APM_01, APM_02, APM_05, APM_07, APM_11,
APM_18, APM_21, APM_23, APM_31, APM_34, APM_35, APM_37, APM_41,
APM_45, APM_47, APM_49).
EXECUTE.
*Center items. Note item 2 is reverse coded.
COMPUTE cAPM_01 = APM_01 – acqindex.
COMPUTE cAPM_02 = -1*(APM_02-acqindex).
COMPUTE cAPM_03 = APM_03 – acqindex.
.
.
.
COMPUTE cAPM_50 = APM_50 – acqindex.
EXECUTE.
*Create scale scores.
COMPUTE PERFORMANCE = mean.1(cAPM_01, cAPM_02, cAPM_03, cAPM_04,
cAPM_05, cAPM_06, cAPM_07, cAPM_08, cAPM_09, cAPM_10).
EXECUTE.
COMPUTE MASTERY = mean.1(cAPM_11, cAPM_12, cAPM_13, cAPM_14,
cAPM_15, cAPM_16, cAPM_17, cAPM_18, cAPM_19, cAPM_20).
EXECUTE.
COMPUTE DOUBT = mean.1(cAPM_21, cAPM_22, cAPM_23, cAPM_24, cAPM_25,
cAPM_26, cAPM_27, cAPM_28, cAPM_29, cAPM_30).
EXECUTE.
COMPUTE EFFORT = mean.1(cAPM_31, cAPM_32, cAPM_33, cAPM_34, cAPM_35,
cAPM_36, cAPM_37, cAPM_38, cAPM_40).
EXECUTE.
```

```
COMPUTE MIND = mean.1(cAPM_41, cAPM_42, cAPM_44, cAPM_45, cAPM_46,
cAPM_47, cAPM_48, cAPM_49, cAPM_50).
EXECUTE.
```

Table A1. Item content of the Multidimensional Achievement-Relevant Personality Scale (MAPS).

Item Content	Original Scale
Performance	
1. It is important to me that my teacher does not think that I know less than others at school.[1]	10
2. Looking smart in comparison to others in my school is not particularly important to me. (R, M)[2]	8
3. One of my goals at school is to avoid looking like I have trouble doing the work.	10
4. One of my goals is to keep others from thinking I am not smart at school.	10
5. It is important to me that I look smart compared to others in my school.[2]	8
6. One of my goals is to show others that I am good at my school work.	8
7. Showing my teacher that I am smarter than other students in my school is not particularly important to me. (R, M)[1]	9
8. The reason I do my work is so others will not think I am dumb.	9
9. One of my main goals is to avoid looking like I cannot do my work.	9
10. I'd like to show my teacher that I am smarter than the other students in my school.	7
Mastery	
11. Learning new things is not an important reason why I do my school work. (R, M)[1]	11
12. I look forward to the opportunity to learn and grow.	29
13. One of my goals in class is to learn as much as I can.	12
14. It is important to me that I learn a lot of new concepts this year.	12
15. I am a true life-long learner.	29
16. I work hard at my studies because I find the material interesting.	5
17. I am thrilled when I learn something new.	29
18. I want to learn as much as possible at school.[1]	4
19. I find that studying academic topics can at times be as exciting as a good novel or movie.	5
20. I do not like to learn a lot of new concepts at school. (R)	23
Self-Doubt	
21. I do not often feel like a failure. (R, M)[1]	31
22. I usually feel that I am an unsuccessful person.	31
23. All in all, I am inclined to feel that I am a failure.[1]	30
24. I take a positive attitude toward myself. (R)	30
25. At times I think I am no good at all.	30
26. I often feel that there is nothing that I can do well.	31

Table A1 (continued).

27. If I do not do as well as other people, it means I am an inferior human being.	14
28. If someone does a task at work/school better than I, then I feel like I failed the whole task.	14
29. People will probably think less of me if I make a mistake.	14
30. I usually have doubts about the simple, everyday things I do.	15
Effort	
31. I do not accomplish a lot of work. (R, M)[1]	36
32. I plunge into tasks with all my heart.	20
33. I work hard.	20
34. I turn plans into actions.[2]	20
35. I don't often carry out my plans. (R, M)[2]	36
36. I am very good at focusing my efforts on attaining a goal.	18
37. I complete tasks successfully.[1]	36
38. When I get what I want, it's usually because I worked hard for it.	32
40. I am an organized person.	19
Hungry Mind	
41. I am full of ideas.[1]	24
42. I love to think up new ways of doing things.	24
44. I have excellent ideas.	24
45. I seek out activities that interest me.[2]	21
46. I quickly get the idea of things.	26
47. I am not full of ideas. (R, M)[1]	26
48. I am able to find out things by myself.	26
49. I am not motivated to become involved in activities related to my interests. (R, M)[2]	21
50. I frequently come up with something new.	27
Removed during replication study	
39. Even if the work is hard, I can learn it.	33
43. I am motivated to expand my understanding of the topics that interest me.	21

Note. The number associated with the original scale derives from Table 1. Items marked R are reverse coded and items marked R, M were changed in content to be reverse coded compared to the original. Items followed by a superscript number are used to calculate the acquiescence index. Items within a scale marked with the same number are semantically opposite pairs.

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