ACADEMIC SELF-CONCEPT UNDER TYPICAL AND MAXIMAL ENVIRONMENTAL PRESS

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ACADEMIC SELF-CONCEPT UNDER TYPICAL AND MAXIMAL ENVIRONMENTAL PRESS

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In memory of my father, Leif J. Ellingsen

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SUMMARY

Academic self-concept (ASC) refers to one's beliefs about himself or herself in academic situations. ASC has been found to be moderately correlated with academic performance when ASC and academic outcome measures are in the same domain and at the same level of specificity. It was hypothesized that differentiating between ASC under typical versus maximal environmental press may increase its predictive validity by providing further specificity to items and thus greater reliability to ASC scales. In this study, a battery of assessments was administered to Georgia Tech undergraduates in order to examine the factor structure of new measures of typical and maximal ASC, as well as their predictive and construct validities. A two-factor model fit the data better than a one-factor model, but did not meet criteria for good fit. Most hypotheses about the relationship between typical and maximal ASC and other constructs were not supported, though gender differences were found which may indicate an interesting line of future research.

CHAPTER 1

INTRODUCTION AND LITERATURE REVIEW

William James (1890/1981) devoted the longest chapter of his *Principles of Psychology* to self-beliefs, in which he proposed self-esteem as the ratio of one's success to one's pretensions. Logical though this definition seemed, it proved problematic in practice (Byrne, 1996). For more than 80 years, the study of self-beliefs was plagued by imprecise definitions and idiosyncratic measures of dubious validity (Shavelson, Hubner, & Stanton, 1976). Modern self-concept research began with a critique of the literature by Shavelson et al. (1976), in which they defined self-concept as "a person's perception of himself" (p. 411). Research has flourished in the past 35 years, refining the structural model of self-concept and demonstrating that self-concept is a useful predictor of important outcomes such as academic achievement (e.g., Kornilova, Kornilov, & Chumakova, 2009; Marsh & Yeung, 1997; Valentine, DuBois, & Cooper, 2004).

My review will define self-concept and specify how it differs from other self-beliefs. I will trace the development of the self-concept literature that is relevant to the present study, focusing on the relationship between academic self-concept (ASC) and academic achievement (AA). I will then review research that has explored the utility of differentiating between typical and maximal behaviors in predicting future behavior. Finally, I will apply the typical/maximal framework to ASC in order to introduce the assessment of typical and maximal ASC which is the subject of the present research.

1.1 Self-Concept and Other Self-Beliefs

Self-concept must be differentiated from other self-beliefs, such as self-efficacy and self-esteem. In their meta-analysis, Valentine et al. (2004) noted theoretical distinctions between the three, but conceded that they are difficult to separate empirically, due to the fact that they are highly correlated with one another and that there is some overlap between the measures of each. Generally speaking, self-esteem is considered to be a measure of overall self-worth (Rosenberg, 1965), or a global perception of one's self as a person (Trautwein, Lüdtke, Köller, & Baumert, 2006). It has a strong affective component in that low self-esteem is generally accompanied by negative affect, and high self-esteem is accompanied by positive affect (Marčič & Kobal Grum, 2011). Self-esteem is at the apex of a hierarchical arrangement of self-beliefs, representing the most general, global, and abstract perception of the self.

Self-efficacy, by contrast, is at the lowest, most specific level of the self-belief hierarchy. It consists of beliefs about one's ability to succeed in specific tasks or attain specific results (Bandura, 1977); measures of self-efficacy typically specify both a task and a criterion for success against which one assesses one's ability (Bong & Skaalvik, 2003). For example, a measure of math self-efficacy may briefly show the respondent a set of math problems and ask for a rating of the likelihood that he or she can answer them correctly (Marsh, Walker, & Debus, 1991).

Self-concept occupies the middle of the self-belief hierarchy, and refers on a general level to the skills and abilities that one possesses (Bong & Skaalvik, 2003). While self-efficacy measures ask respondents what they can do with their skills and abilities, and self-esteem questionnaires ask people how they feel about themselves

overall as a result of their skills and abilities, self-concept assessments query respondents about their assessments of their skills and abilities in a variety of domains (Bong & Skaalvik, 2003). Unlike self-efficacy items, self-concept items do not typically specify performance criteria or contexts. As a result, it is up to the respondent to provide both (Bong & Skaalvik, 2003). There is disagreement among self-concept researchers over the question of whether self-concept should include affective components, such as interest and satisfaction, along with the evaluative component (Bong & Skaalvik, 2003). Arens and colleagues found that competence and affective components of ASC were differentiable, although highly correlated, and that the competence scales were better predictors of grades than were the affective scales ($r \cong .50$ between the competence scales and AA, as opposed to $r \cong .25$ for the affective scales; Arens, Yeung, Craven, & Hasselhorn, 2011). A measure of self-concept might ask respondents to rate their level of agreement with statements such as "I can write effectively" or "I have hesitated to take courses that involve mathematics" (reverse scored; Marsh & O'Neill, 1984, p. 169).

1.2 The Structure of Self-Concept

There are no clear lines of demarcation between these three levels of self-belief, and the theoretical literature notes that both self-concept and self-efficacy can be measured at varying levels of specificity (Bandura, 1997; Bong & Skaalvik, 2003; Shavelson et al., 1976). Perhaps partly for this reason, some ambiguity is inherent in the self-concept construct, and theoretical work on its structure has evolved considerably in the past few decades. The most extensively validated model (Byrne, 1996) is the Marsh/Shavelson model of self-concept. According to this model, self-concept includes both descriptive and evaluative components, which are formed by a person's experiences

with the environment and are influenced by significant others (Shavelson et al., 1976). Shavelson and his colleagues suggested that self-concept could be useful in predicting and explaining how a person acts, and posited a reciprocal relationship between self-concept and behavior, but did not specify the nature of this relationship or its mechanisms. They also proposed (but did not validate) a hierarchical structure with general self-concept at the apex and layers of increasingly domain-specific self-concepts beneath it, and hypothesized that the domains likely become more differentiated (i.e., less correlated with each other) throughout development from childhood to adulthood (Shavelson et al., 1976).

Despite the prediction by Shavelson and colleagues that the structure of self concept changes during development, most self-concept research focused on preadolescent children until Marsh and O'Neill (1984) designed the Self-Description Questionnaire-III (SDQ-III) to examine self-concept in late adolescents. Grounded in the Shavelson et al. (1976) model, the SDQ-III capitalizes on late adolescents' better-developed verbal abilities and targets 13 areas of self-concept presumed to be important to high school and university students: mathematics, verbal, academic, problem-solving, physical abilities, physical appearance, same-sex peers, opposite-sex peers, relations with parents, religion/spirituality, honesty/reliability, emotional stability, and general self (Marsh & O'Neill, 1984). Marsh and O'Neill (1984) hypothesized a strong hierarchy similar to the one proposed by Shavelson et al. (1976), but found that the 13 factors were largely uncorrelated with each other (see also Marsh, Byrne, & Shavelson, 1988; Marsh & Shavelson, 1985; Marsh et al., 1991). Interestingly, they noted that although math and verbal achievement were highly correlated with each other, and self-concept in each

domain was highly correlated with achievement in the same domain, math and verbal self-concept were uncorrelated with each other (see also Ackerman & Wolman, 2007).

Marsh and colleagues (Marsh, 1986; Marsh et al., 1988) explored this curious finding, and suggested that there are two different frames of reference that impact self-concept ratings, particularly in academic domains. Specifically, students use both external (comparing their own abilities to those of other students) and internal (comparing their own abilities in one domain to their own abilities in other domains) frames of reference when forming domain-specific ASC. Because math and verbal abilities are substantially correlated with each other, external comparisons lead to a positive relationship between math ASC and verbal ASC; however, at the same time, internal comparisons amplify the intraindividual differences between math and verbal abilities, resulting in a negative relationship between math ASC and verbal ASC. Taken together, the two comparisons cancel out each other, yielding a near-zero correlation between math ASC and verbal ASC (Marsh, 1986). These findings highlight the affective component of self-concept: a purely cognitive, descriptive account of abilities should result in moderate correlations between self-belief and actual achievement regardless of the frame of reference. The fact that context matters indicates the importance of affective assessment in self-concept measures.

Further development of the structure of ASC found that a model with two higher-order factors, math ASC and verbal ASC, fit the data better than a model with only one, general higher-order factor (Marsh, 1990b). However, Marsh noted that a large amount of the variance in the first-order factors (i.e., ASC in specific subject areas such as math, physical science, biological science, history, and English) was not explained by the

variance in the two higher-order factors, indicating the importance of measuring ASC for each domain separately.

1.3 Academic Self-Concept and Academic Achievement

Many studies have found significant relationships between ASC and academic achievement (AA; e.g., Choi, 2005; Denissen, Zarrett, & Eccles, 2007; Kornilova et al., 2009; Marsh & Yeung, 1997), but the direction of the relationship remained unexplored for some time. Calsyn and Kenny (1977) described two rival hypotheses regarding the direction of the relationship between ASC and AA: the skill development model, in which ASC is a consequence of AA, and the self-enhancement model, in which AA is a consequence of ASC. They favored the former. By contrast, Marsh (1990a) proposed a reciprocal effects model in which prior ASC predicts later AA and vice versa. This model has received considerable support by Marsh and his colleagues (e.g., Guay, Marsh, & Boivin, 2003; Marsh & Craven, 2006; Marsh & Yeung, 1997; see also the meta-analysis by Valentine et al., 2004), including some studies which have found, contrary to Calsyn and Kenny's (1977) conclusion, that ASC is a better predictor of AA than the reverse (Marsh, Trautwein, Lüdtke, Köller, & Baumert, 2005). In addition, multiple studies have found that ASC predicts subsequent AA above and beyond prior AA (Kornilova et al., 2009; Marsh et al., 2005; Marsh & Yeung, 1997).

However, some studies have found no significant relationship between ASC and AA. A meta-analysis (Valentine et al., 2004) of the relationship between various self-beliefs (e.g., self-concept, self esteem, self-efficacy, self-image) and AA reported an average effect size of only $\beta = .08$, but noted that effect sizes exceeded $\beta = .10$ in several studies in which the self-beliefs were domain-specific and were well-matched to the

achievement outcomes used in the study (see also Pinxten, De Fraine, Van Damme, & D'Haenens, 2010). These results can be understood within the framework of Brunswik Symmetry (Wittmann & Suß, 1999), which states that predictor and criterion variables must be symmetrical to each other – when hierarchies are involved, this means that the predictor and criterion variables should be drawn from the same level of the hierarchy. For example, an attempt to predict success in a math course from a measure of global self-esteem is unlikely to be successful, since the predictor (global self-esteem) is very broad and the criterion (a grade in one semester-long math course) is relatively specific. Studies that have specifically examined the importance of symmetry for self-concept predictor and criterion variables have supported this framework as well (e.g., Choi, 2005; Lent, Brown, & Gore, 1997; Pajares & Miller, 1995), and this work helps to explain the many studies that have reported the usefulness of ASC for predicting AA (Kornilova et al., 2009; Marsh et al., 2005; Marsh & Yeung, 1997), despite the discouraging results of the Valentine et al. (2004) meta-analysis.

In many applied situations, psychologists and educators are most interested in predicting academic success over time (operationalized by college grades, an intermediate-level criterion). Brunswik Symmetry dictates that ASC, an intermediate-level predictor, will be a more valid predictor (compared with other self-beliefs) of AA. Indeed, Bong and Clark (1999) note that ASC is in fact the best and most commonly used predictor of AA among the self-beliefs.

However, despite the large amount of research dedicated to describing the structure of ASC and its relationship to AA, apparently no research has explicitly sought to improve its predictive power. Given that commonly used predictors of collegiate AA

such as high school grades and standardized tests leave much of its variance unaccounted for (Kobrin, Patterson, Shaw, Mattern, & Barbuti, 2008), and given that ASC measures have been shown to provide predictive value over and above conventional intelligence tests even among highly selective student groups (Kornilova et al., 2009), an attempt to increase the predictive power of ASC may be a worthwhile endeavor. This task has been accomplished in other domains by differentiating between typical and maximal environmental situations and assessments.

1.4 The Typical/Maximal Framework

Cronbach (1970) differentiated between tests of ability and tests of typical behavior. Tests of ability seek to elicit the best possible performance from the examinee, in part by providing clear expectations as to what constitutes a good or correct response. Examples include intelligence tests (Cronbach, 1970) and work samples (Deadrick & Gardner, 2008). In both of these situations, the examinee is highly motivated to perform as well as possible for a finite period of time (i.e., until the end of the assessment). Measures of typical performance, by contrast, seek to assess the behavior that the examinee is most likely to exhibit across many situations. There usually is no objectively defined "best" or "ideal" score on assessments of typical behavior; the score is meant to reflect the person's usual behavior in the absence of strong environmental pressure to perform better. Measures of typical performance often are used when a measure of maximal performance would not be meaningful. For example, in some situations, the most interesting or relevant question is not whether a person is *capable* of engaging in a behavior, but whether he or she actually *does* engage in the behavior when not being assessed (Cronbach, 1970).

However, the typical/maximal distinction is another case in which Brunswik Symmetry must be considered. The nearly ubiquitous finding of low correlations between personality and intelligence variables is one example: there is an asymmetry between personality assessments, designed to assess typical behavior, and intelligence tests, intended to assess maximal performance (Goff & Ackerman, 1992). Perhaps it should not be surprising, then, when only a weak correlation is found between personality assessments and intelligence tests.

Some investigators have attempted to bridge this divide between typical and maximal assessment frameworks by measuring maximal levels of behaviors that are usually assessed as typical behaviors, or by assessing typical levels of behaviors that are usually measured under maximal performance conditions. For example, Goff and Ackerman (1992) developed a measure of typical intellectual engagement (TIE) in order to assess intelligence from a dispositional perspective – that is, to assess a person's usual, everyday level of intellectual engagement under non-assessment situations, which may be quite different from the same person's performance on an intelligence test for which he/she is exerting maximum effort. Similarly, Wallace (1966) distinguished between "response predisposition" and "response capability" (p. 132) in personality research. He argued for an abilities approach to personality that would focus on determining whether an individual is capable of responding in a particular way or at a particular level when the situation demands it, rather than attempting to assess what the individual is most likely to do when left to his or her own devices.

A separate but related issue in designing assessments of typical behaviors is the problem of ambiguity. Mischel (1977) argued that people will be most accurate in their

self-reports when the criterion measures are highly specified. That is, items that ask about general criteria such as "job success" will yield less accurate responses than will questions about specific criteria such as accuracy on a given task. In their research on maximal personality, Willerman, Turner, and Peterson (1976; see also Turner, 1978) suggested that their maximal measures were more accurate predictors of behavior in laboratory situations because they were less ambiguous: the maximal measures asked participants to focus on only one end of the spectrum of their possible behaviors, while the typical questions essentially asked participants to take a weighted average of their behavior in all possible situations. The wide range of possible situations likely caused participants to use a few salient instances as the basis for their self-ratings, whether or not these salient instances were representative of their behavior overall. It should be noted that in these studies, only the maximal assessments constrained the range of situations that participants were asked to consider. It is possible that constraining the range of situations to be considered in the typical assessment would have increased its predictive validity as well.

1.5 The Present Investigation

ASC has been shown to be a predictor of AA, but its predictive power could be improved. Considering that student retention is a major goal of many colleges and universities (Hsieh, Sullivan, & Guerra, 2007), a simple, low-cost tool that could identify students who are at risk for academic failure could be highly useful. Currently, standardized college-entrance tests (the SAT and the American College Test, or ACT) and high school grades are the most widely used predictors of college grade-point average (GPA), but these predictors account for less than half of the variance in first-year

college GPA (Kobrin et al., 2008). This may be due in part to a lack of Brunswik Symmetry, in that the SAT and ACT measure maximal performance, while college GPA may be better conceptualized as measuring typical behavior. This conceptualization is rooted in the fact that grades in college courses (based on work such as essays and cumulative final exams) reflect sustained effort over time (Ackerman & Kanfer, 2004).

The line between typical and maximal measures of performance can be a fuzzy one, especially for complex indicators such as college GPA. Grades in most undergraduate classes are based largely on exams, which elicit maximal effort from the vast majority of examinees. However, performance on those exams likely is determined to a large extent by a student's behavior under weaker environmental pressure. A student who regularly invests time and effort to learn course content in the weeks (rather than hours) leading up to an exam may or may not perform better than a student who "crams" only under the environmental pressure of an impending exam (though long-term retention after the course is over may differ). In addition, the sheer number of grades on individual exams, papers, and projects that comprise the overall GPA also would be consistent with the conceptualization of GPA as an indicator of typical behavior. In order to obtain a high GPA, a student must perform well not on one exam, or on several assignments that strike his/her interest, but rather on many assignments in many different classes over the course of months and years. Thus, I expected that GPA indicates the degree to which a student has exerted sufficient effort to perform well on a variety of discrete tasks over a relatively long period of time – in other words, the typical level of performance that a person demonstrates on tasks requiring maximal effort. For both of these reasons, I

expected that GPA is an indicator of typical performance, despite the fact that it may be based on a series of maximal performance events.

For example, Chamorro-Premuzic, Furnham, and Ackerman (2006) reported that TIE was more highly correlated with class exams, essays, and projects than was a measure of general cognitive ability among university students. Of course, the range of cognitive ability among university students is restricted; these authors suggested that measures of typical behavior such as TIE become increasingly useful predictors of academic performance at higher levels of education precisely because of this range restriction in cognitive abilities.

Existing ASC measures do not differentiate between typical behavior and maximal performance. Many scales (e.g., Marsh & O'Neill, 1984; Marsh et al., 2005; Marsh, Trautwein, Lüdtke, & Köller, 2008) mix typical and maximal items in the same scale, or include items that do not specify a typical or maximal context, or both. An ASC measure with separate typical and maximal components may serve two purposes. First, it may increase the reliability of the overall measure by narrowing the range of situations addressed by any one item, thus reducing ambiguity at the item level. Second, it will provide two separate scores (i.e., typical ASC and maximal ASC) that can be used to predict performance for either typical or maximal outcomes. This may increase its predictive validity for GPA in one of two ways. First, if GPA is best viewed as a measure of typical performance, a typical ASC measure will provide increased predictive power through Brunswik Symmetry. Alternatively, if the range of maximal ASC is restricted in the college population (due to a selective admissions process coupled with attrition of poor-performing students), its predictive validity may be reduced. Goff and

Ackerman (1992) suggested that measures of typical intelligence may be particularly useful in situations in which maximal measures have decreased predictive validity; the same may be true for ASC. As a result of these factors, it can be expected that separate measures for maximal ASC and typical ASC – and perhaps especially typical ASC – may be useful supplements to the traditional predictors of college GPA.

For my study, I developed a new measure of ASC consisting of 12 individual scales to assess ASC for situations involving typical and maximal environmental pressure in each of six domains: general academic, math, mechanical, problem solving, spatial, and verbal. The scales combine to form two composites – one maximal, one typical – comprised of the six corresponding scales. The maximal ASC scales focus on school-related assessment situations, such as class projects, exams, and grades, while the typical scales focus on the use (or non-use) of academic-related skills and knowledge in everyday life, in the absence of a formal assessment situation. This study examined the structure of the new measure and the relationship of its composites and scales to academic indicators and other personality and achievement-related constructs. The a priori expectations regarding these relationships are described below.

1.6 Typical/Maximal ASC and AA

1.6.1 Relationship between typical and maximal ASC

I expected that the twelve subscales in the new typical/maximal ASC measure would load on two higher-order factors, one corresponding to the typical subscales, and the other to the maximal subscales. I expected that typical ASC and maximal ASC would be strongly and positively correlated with each other, but that they would be differentiable and would have different relationships with other psychological constructs,

as discussed below. It should be noted that in a sample drawn from the Georgia Tech participant pool, the distribution of self-ratings of maximal ASC likely will be negatively skewed, since it consists of students who applied to, were accepted into, and remain enrolled in a highly selective university. However, typical ASC scores may be more normally distributed and less restricted in range, and thus more useful in predicting academic performance.

Hypothesis 1: Confirmatory factor analysis will support a two-factor model consisting of typical ASC and maximal ASC factors, and this two-factor model will fit the data significantly better than a one-factor model.

1.6.2 Academic achievement

As noted above, studies that have examined the relationship between ASC and GPA are nearly unanimous in reporting a significant correlation between the two, though the strength of the correlation ranges from r = .27 (Rinn & Cunningham, 2008) to r =.60 (Kornilova et al., 2009; see also Choi, 2005). One exception is Rinn and Cunningham's (2008) study of high-ability college students (r = .18, *ns*); the authors suggested that this could be due to a restriction of range in the GPAs. Because college GPA can be conceptualized as the result of sustained effort over a long period of time and therefore an indicator of typical performance (Ackerman & Kanfer, 2004), I expected that GPA at Georgia Tech (Institute GPA) would be more highly correlated with typical ASC than with maximal ASC.

Hypothesis 2: The relationship between the typical ASC composite and GPA will be stronger than the relationship between the maximal ASC composite and GPA (anticipated difference: r = .15).

Both high school GPA and standardized test scores predict college grades, but leave a substantial proportion of the variance unaccounted for, partly because each provides less than $\Delta R = .10$ in incremental validity over the other (Kobrin et al., 2008). Marsh et al. (2005) reported a correlation of $r = .24$ between ASC and subsequent grades when holding prior academic achievement constant, while Kornilova et al. (2009) reported a correlation of $r = .59$ for GPA and ASC while controlling for intelligence, age, sex, and field of study. Thus, I hypothesized that ASC would provide incremental validity for predicting Institute GPA over and above high school GPA and SAT scores.

Hypothesis 3: Typical ASC and maximal ASC together will significantly predict variance in college GPA above and beyond that predicted by SAT scores and high school GPA.

1.7 Expected Group Differences in ASC

Defensive pessimism, year in college, and gender were examined as potential sources of group differences in the present study.

1.7.1 Defensive pessimism

Defensive pessimism is a coping strategy in which students harness their anxiety for use as motivation by setting unrealistically low expectations about performance in risky situations (Norem & Cantor, 1986). No studies could be found that related ASC to defensive pessimism, but the latter may be important to studies of the former, given that ASC is a rating of one's beliefs about one's abilities. The use of defensively pessimistic strategies has been linked to anxiety, but not to performance outcomes or to overly pessimistic postdictions about performance. However, defensive pessimists have been shown to be less satisfied with their performances than optimists (Norem & Cantor, 1986), which may influence their self-ratings of their academic abilities.

Because typical ASC items have been designed to tap self-concept in everyday, non-assessment situations, I predicted that there would be no significant relationship between defensive pessimism and typical ASC. Maximal ASC, by contrast, references situations such as classroom performance in which assessment is salient, and anxiety may be at a maximum. Although ASC develops as a result of past performance (Marsh & Yeung, 1997), and defensive pessimists do acknowledge their past academic success (Norem & Cantor, 1986), ASC scales imply a predictive element regarding future performance, and scores of ASC may be reduced among those who engage in defensive pessimism. It should be noted that the Defensive Pessimism Questionnaire (DPQ; Norem & Cantor, 1986) is a categorical scale that is designed to identify those people who are more likely to use either defensive pessimism or optimism, rather than a continuous scale that measures "how much" of a defensive pessimism trait a person possesses. Thus, people may be categorized as defensive pessimists, as optimists, or as neither; they are not given a defensive pessimism "score" on a continuous scale. I hypothesized that defensive pessimists would have lower maximal ASC scores as a group than those who do not use these strategies.

Hypothesis 4: Defensive pessimists will have lower scores than non-defensive pessimists on maximal (but not typical) ASC.

1.7.2 Year in college

Year in college is likely to be positively correlated with maximal ASC due to differential attrition of students who have an especially low maximal ASC, whether due to objectively poor performance or to overly pessimistic self-beliefs. House (1993) found that ASC was a significant predictor of student withdrawal from college over four years,

with lower ASC predicting dropout. In addition, research on gifted students has suggested that the "big-fish-little-pond effect" acts to reduce ASC when students first enter advanced or accelerated academic programs (Marsh, 1987), and a similar process may occur with high-caliber students when they first enter a selective university (Rinn, 2005). Both of these factors should primarily affect maximal ASC, since this part of ASC is most directly associated with classroom performance.

Hypothesis 5a: Students who have earned more college credits will have higher maximal ASC.

In addition, because GPA is an average, and averages stabilize over time, it was predicted that maximal ASC would become more closely associated with Institute GPA later in the college career, as GPA becomes a better indicator of academic performance over time and is less influenced by any one particular course grade. Students who have completed more college courses should also have a better basis for assessing their own academic abilities in classroom settings; therefore, their ASC ratings should be more accurate than ratings made by students earlier in their college careers.

Hypothesis 5b: Maximal ASC will be more highly correlated with GPA among students who have earned more college credits.

1.7.3 Gender

Several researchers have reported gender differences in ASC (Marsh, 1994; Marsh et al., 2005; Sullivan, 2009), favoring men and boys for math ASC and women and girls for verbal ASC. Therefore, I predicted a main effect of gender in the present study. It is important to note, however, that the underlying structure of ASC has been

shown to be the same for both sexes, meaning that it is appropriate to compare the mean ASCs of males and females (Marsh et al., 2005).

Hypothesis 6a: Men will have significantly higher typical and maximal ASC ratings for math, spatial, and mechanical domains, compared to women.

Hypothesis 6b: Women will have significantly higher typical and maximal ASC ratings for the verbal domain, compared to men.

1.8 Predicted Correlates of Typical and Maximal ASC

1.8.1 Personality

Surprisingly little research has linked self-concept with core personality traits such as the Big Five (Marsh, Trautwein, Lüdtke, Köller, & Baumert, 2006). One of the few studies explicitly exploring the relationship between these constructs found significant correlations between the personality trait openness and verbal self-concept (r = .49) and math self-concept (r = -.12), and between conscientiousness and both problem solving self-concept (r = .28) and math self-concept (r = .26; Marsh et al., 2006; see also Pulford & Sohal, 2006). Other research (Peterson & Whiteman, 2007) has found a correlation between ASC and openness that is significant but small (r = .15). This large discrepancy in magnitude may result at least in part from the fact that Marsh and colleagues surveyed German high school students, while Peterson and Whiteman studied college students in Scotland and New Zealand. The latter sample may have suffered from a restriction of range on one or both of the variables in comparison to the German sample, thereby lowering the correlation. In addition, Ackerman and Wolman (2007) reported significant, positive correlations between verbal ASC and trait complexes that

included conscientiousness (r = .29), openness (r = .20), and extraversion (r = .28) in a sample of U.S. college students and recent graduates.

Because personality inventories tap typical behaviors, I expected that they would correlate more highly with the typical ASC composite than with maximal ASC composite. In addition, it was conceptually important to distinguish typical ASC from openness. Therefore, openness and conscientiousness were examined in terms of their relationships with typical and maximal ASC.

Hypothesis 7a: Conscientiousness will be positively and significantly more strongly correlated with typical ASC than with maximal ASC.

Hypothesis 7b: Openness will be positively and significantly more strongly correlated with typical ASC than with maximal ASC.

1.8.2 Typical intellectual engagement

As discussed above, TIE measures people's "desire to engage and understand their world, their interest in a wide variety of things, and their preference for a complete understanding of a complex topic or problem, a need to know" (Goff & Ackerman, 1992, p. 539). In a series of studies, Ackerman and colleagues reported significant correlations between TIE and ASC both for a composite ASC measure (r = .18; Kanfer, Ackerman, & Heggestad, 1996) and for the verbal component of that measure (r = .35; Ackerman, Kanfer, & Goff, 1995). Correlations between TIE and the other subscales relevant to the present study – mechanical, math, and spatial – were nonsignificant and near zero (r < .05). Given that TIE and typical ASC both assess behavior in non-achievement situations, I expected that the relationship between typical ASC and TIE would be stronger than the relationship between maximal ASC and TIE. Similar to the relationship

between typical ASC and openness, however, it was important to ensure that typical ASC and TIE are distinguishable constructs.

Hypothesis 8: The relationship between typical ASC and TIE will be positive and will be significantly greater than the relationship between maximal ASC and TIE.

1.8.3 Protestant work ethic

The Protestant work ethic has been associated with need for achievement, restraint, delay of gratification, perseverance on boring tasks, and a mastery orientation to learning (for a review, see Furnham, 1984). The Protestant Ethic Scale (Mirels & Garrett, 1971) emphasizes a belief in the inherent value of hard work and sacrifice, and Furnham (1984) suggested that people who endorse the Protestant work ethic believe that sustained hard work will pay off in the long run. Therefore, this construct provided another important test of discriminant validity for typical ASC. I expected that Protestant work ethic would correlate positively with both typical and maximal ASC, but more highly with typical ASC than with maximal ASC.

Hypothesis 9: The relationship between Protestant work ethic and typical ASC will be positive and will be significantly stronger than the relationship between Protestant work ethic and maximal ASC.

1.8.4 Identification with academics

Identification with academics is the extent to which a person bases his or her overall feelings of self-worth on his or her academic performance (Osborne, 1997). It is a form of domain identification, which has been linked to domain-specific outcomes in other areas (Osborne & Jones, 2011). Higher identification with academics has been related to academic success (Osborne, 1997), and to intrinsic motivation and cognitive

engagement (Walker, Greene, & Mansell, 2006). Identification with academics has been shown to correlate modestly with GPA (r = .23) and with global self-esteem (r = .31; Osborne, 1997), and also with self-efficacy (r = .17), and more substantially with intrinsic motivation (r = .43), and meaningful cognitive engagement (r = .50; Walker et al., 2006).

Because students who identify strongly with academics base their self-esteem specifically on academic outcomes such as grades and test performance, I predicted that identification with academics would be more closely tied to maximal ASC than to typical ASC.

Hypothesis 10: The correlation between identification with academics and maximal ASC will be positive and will be significantly stronger than the correlation between identification with academics and typical ASC.

1.8.5 Goal Orientation

Motivation researchers have identified four different goal orientations: mastery-approach (aim to achieve actual competence), mastery-avoidance (aim to avoid failing to achieve actual competence), performance-approach (aim to demonstrate competence compared to others), and performance-avoidance (aim to avoid failing to demonstrate competence compared to others; Elliot & McGregor, 2001). Goal orientation has been linked to academic achievement (Harackiewicz, Barron, Tauer, & Carter, 2000) and to education-relevant outcomes such as effort (Chouinard, Karsenti, & Roy, 2007) and procrastination (Howell & Buro, 2009). Skaalvik (1997) reported relationships between ASC and task (i.e., mastery) orientation, avoidance orientation, self-enhancing ego (i.e., performance approach), and self-defeating ego (i.e., performance avoidance) of β = .25,

-.15, .23, and -.33, respectively. Haugen, Ommundsen, and Lund (2004) reported significant correlations between ASC and motive to seek success (r = .30), and between ASC and motive to avoid failure (r = -.23). Therefore, I expected that the correlations between typical ASC and a mastery-approach orientation would be significant and positive.

Hypothesis 11: The relationship between typical ASC and a mastery-approach goal orientation will be positive and will be significantly greater than the relationship between maximal ASC and mastery-approach goal orientation.

1.8.6 Implicit theories of intelligence

According to Dweck (1999), a person's implicit beliefs about the nature of intelligence can influence his or her interpretation of and response to successes and failures related to intellectual and academic tasks. People who subscribe to an entity theory of intelligence believe that intelligence is fixed and cannot be changed with effort, while those who accept an incremental theory of intelligence believe that intelligence can be increased through the application of effort to master new things (Dweck, 1999). While no studies could be found that related implicit theories of intelligence directly to ASC, at least one study has linked implicit theories to goal orientation. Hypotheses about the relationship between implicit theories and typical/maximal ASC were developed based on these findings.

College students who adopt an entity theory of intelligence tend to adopt performance-related goals, while those who adhere to an incremental theory tend to emphasize mastery/learning goals (Robins & Pals, 2002). This suggests an underlying difference in their approach to learning and intellectual engagement: those who believe in

the malleability of intelligence through effort (i.e., incremental belief) welcome challenges and opportunities to increase their intelligence, while those with entity beliefs tend to avoid challenges because of the possibility of failure and thus demonstration of a lack of ability (Dweck, 1999). Because typical ASC assesses a person's self-concept regarding everyday, potentially avoidable challenges, I predicted that holding incremental beliefs of intelligence would be related to higher typical ASC.

Hypothesis 12: The relationship between typical ASC and an incremental theory of intelligence will be positive and will be significantly stronger than the relationship between maximal ASC and an incremental theory of intelligence.

1.8.7 Intrinsic and extrinsic motivation

Motivation researchers have distinguished between intrinsic motivation (motivation to engage in an activity because the person finds it inherently interesting or engaging) and extrinsic motivation (motivation to engage in an activity as a means of obtaining results or in response to the demands of others; Amabile, Hill, Hennessey, & Tighe, 1994). Because typical ASC by definition assesses self-concept in situations in which there are no explicit rewards (such as grades) to be gained, the relationship between typical ASC and intrinsic motivation was predicted to be significantly stronger than the relationship between typical ASC and extrinsic motivation. Maximal ASC was not expected to correlate differentially with either intrinsic or extrinsic motivation.

Hypothesis 13: The correlation between typical ASC and intrinsic motivation will be positive and will be significantly stronger than the correlation between maximal ASC and intrinsic motivation.

1.8.8 Vocational interest

Substantial overlap has been found between vocational interests and self-estimates of abilities, and self-estimates appear to affect career choice both directly and through their effect on interests (Darcy & Tracey, 2003). Similarly, self-confidence in academics has been linked to investigative, artistic, and social career interests (Mullis, Mullis, & Brailsford, 1997). Because measures of interests and of self-estimates of abilities emphasize typical behavior, they may be more relevant to job choice than are maximal ability measures such as general intelligence (Darcy & Tracey, 2003). Jobs that are more intellectually demanding may be more appealing to people who are predisposed to engage in intellectual behavior in their everyday lives, and to have high self-beliefs regarding that type of behavior.

Hypothesis 14a: Typical ASC will be significantly correlated with Investigative, Artistic, and Social career interests and not with the remaining career interests. Maximal ASC will not be differentially correlated with the various career interests.

In addition, a general interest factor for vocational interests has been identified, representing a tendency to report being interested in jobs or tasks overall (Darcy & Tracey, 2003). Though its meaning has been debated (see Darcy & Tracey, 2003, for a discussion), this factor can be interpreted as an indicator of flexibility (Darcy & Tracey, 2003) and has been shown to have a moderate correlation with typical intellectual engagement but only a small correlation with maximal intelligence (Ackerman & Heggestad, 1997). If typical ASC does indeed measure one's assessment of one's own general, everyday engagement in tasks in various academic domains, then it should be related to the general interest factor. Maximal ASC, because it refers to situations

involving strong environmental pressure to perform, should have a low or negligible correlation with the general interest factor.

Hypothesis 14b: Typical ASC, but not maximal ASC, will be significantly correlated with the general interest factor in vocational interests.

The main hypothesis (i.e., that Institute GPA will be significantly more strongly correlated with typical ASC than with maximal ASC) involved a comparison of dependent correlations, for which the Williams's T_2 statistic has been found to be superior to Hotelling's T_1 (Steiger, 1980). An equation for a power analysis using Williams's T_2 could not be found. In order to determine sample size, several possible combinations of sample sizes and effect sizes were used to solve the Williams's T_2 equation at the $\alpha = .05$ level. It was found that a sample size of 220 would yield significant results provided that $r_{13} - r_{23} > .15$, where r_{13} is the correlation between typical ASC and Institute GPA, and r_{23} is the correlation between maximal ASC and Institute GPA.

CHAPTER 2

METHOD

2.1 Participants

Two hundred twenty current Georgia Tech undergraduates were recruited from the Georgia Tech participant pool. Recruitment flyers, in-class announcements, and an Experimetrix posting indicated that participants had to be native English speakers and must have submitted SAT scores to Georgia Tech with their application for admission. The study description informed participants that the study was designed to examine self-perceptions, attitudes, interests, and personality.

The participants were recruited during the summer and fall semesters of 2012. Academic data (SAT, high school GPA, Institute GPA, or some combination thereof) were not available for nine of the participants as of the end of the fall 2012 semester, so these participants were eliminated prior to data analysis. One additional participant had a college GPA that was more than three standard deviations below the sample mean and therefore was eliminated prior to analysis. This left 210 participants in the final sample. Of this sample, 95 (45.2%) were male and 115 (54.8%) were female.

2.2 Procedure

Participants attended one in-person group session in the lab. Upon arrival, they were asked to respond to written questions regarding their eligibility, which were reviewed by the experimenter before continuing. After giving informed consent, including consent to allow the researcher to obtain Institute GPA, number of college credits obtained, major field of study, high school GPA, and SAT scores from the

participant's academic record, participants completed several assessments as described below. The majority of participants finished the entire process within approximately one hour. After completion of the session, participants were debriefed and assigned one research credit via Experimetrix.

2.3 Measures

2.3.1 Typical and maximal academic self-concept measure

The typical and maximal ASC scales were developed for the current study. Items were generated by adapting items from existing self-concept measures (Denissen et al., 2007; Goff, 1994; Marsh, 1990b; Marsh et al., 2005; Marsh & O'Neill, 1984; Viswanathan, 1993) and from informal interviews with current and recently-graduated college students. In generating the items, care was taken to ensure that the wording clearly distinguished between typical and maximal situations, and that items focused on competence rather than affect, as suggested by Arens et al. (2011). The typical ASC composite measure consists of 77 items and the maximal ASC composite measure consists of 84 items; for each measure, items are divided into six scales: verbal, math, problem solving, general/academic, mechanical, and spatial. Each of the 12 scales contains between 12 and 17 items. Responses are made on a six-point Likert-type scale ranging from 1 (strongly disagree) to 6 (strongly agree). Items are listed in the Appendix.

The total score for each of the 12 scales represented the sum of ratings across all items in the scale. Because the scales varied in number of items, the typical ASC and maximal ASC composites were calculated by converting each of the 12 scales into *z*-scores and summing the *z*-scores of the six scales for each composite (i.e., the six

maximal scales and the six typical scales). This allowed each scale score to contribute equal weight to its respective composite, regardless of the number of items in the scale.

2.3.2 Academic achievement measures

Academic achievement was assessed by obtaining participants' cumulative Institute GPA, SAT score, and high school GPA from their university records. Institute GPA is calculated based on credits earned at Georgia Tech; grades earned in courses transferred from other institutions are not included.

2.3.3 Demographics

A demographics questionnaire asked participants to indicate their age and sex.

2.3.4 Defensive pessimism

The Defensive Pessimism Questionnaire (DPQ; Norem & Cantor, 1986) consists of nine statements, and participants are asked to rate their agreement with each statement from 1 (very untrue of me) to 6 (very true of me)[1]; an optimism-pessimism score is calculated by subtracting the sum of endorsements of pessimistic items from the sum of endorsements of optimistic items. Norem and Illingworth (1993) reported an internal consistency reliability of $\alpha = .84$ and a test-retest reliability of $\alpha = .73$ in a sample of college students. As discussed earlier, the DPQ is intended to be used as a prescreening measure to identify people who use either optimistic or defensively pessimistic strategies; it is not designed to differentiate between people in the middle of the scale (Norem & Cantor, 1986). Therefore, consistent with Norem & Illingworth (1993), the DPQ was used to identify participants in the most defensive quartile of the distribution in order to investigate defensive pessimism strategies as a potential moderator of academic-self-

[1] The original DPQ uses a response scale of 1 to 11. In order to maintain consistency with the other scales used in this experiment, a response scale of 1 to 6 was used.

concept. A sample item from this measure is "I go into academic situations expecting the worst, even though I know I will probably do OK" (Norem & Cantor, 1986, p. 1211).

2.3.5 Personality

Personality was assessed using the NEO-FFI (Costa & McCrae, 1992), a 60-item measure that assesses the Big Five personality traits. Response choices range from 1 (very untrue of me) to 6 (very true of me). John & Srivastava (1999) reported a Cronbach's α exceeding .70 for all five subscales of the NEO-FFI in a sample of college students, including conscientiousness (α = .83) and openness (α = .70).

2.3.6 Typical intellectual engagement

Typical intellectual engagement (TIE) was assessed using the short form of the Typical Intellectual Engagement scale (Goff & Ackerman, 1992). Participants respond to the 12-item scale on a six-point Likert-type scale ranging from 1 (strongly disagree) to 6 (strongly agree). This scale was found to have an internal consistency reliability of α = .86 in a large sample of high school seniors (P.L. Ackerman, personal communication, March 24, 2012). A representative item from this scale is "Thinking is not my idea of fun" (reverse scored; Ackerman & Goff, 1994, p. 151).

2.3.7 Protestant work ethic

The most commonly used measure of the Protestant work ethic (Furnham, 1984) is the Protestant Ethic Scale (PES; Mirels & Garrett, 1971). In a large study involving participants from 13 countries, the PES was found to have an internal consistency reliability α = .69 (Furnham, Masters, et al., 2001); another study by Furnham and Koritsas (1990) reported a reliability of α = .70. Thus the Cronbach's α appears to be acceptable; although both of those studies found higher reliabilities for some other

Protestant work ethic scales, these scales have not been used as extensively, if at all, in the literature (Furnham & Koritsas, 1990; Furnham, Masters, et al., 2001). The original PES asks respondents to rate their agreement with each item on a scale of -3 (I disagree strongly) to 3 (I agree strongly), with zero excluded. However, since the original measure adds four to each item to convert responses into an all-positive scale for scoring purposes, the items were presented on a scale of one to six.[2] A sample item from the PES is "People who fail at a job have usually not tried hard enough" (Mirels & Garrett, 1971, p.41).

2.3.8 Identification with academics

Identification with academics was assessed using Osborne's (1997) Identification with Academics Scale (IAS), which consists of 13 items rated on a scale of 1 (strongly disagree) to 6 (strongly agree).[3] Osborne (1997) reported an internal consistency reliability of $\alpha = .82$, and subsequent research has reported an internal consistency reliability of $\alpha = .77$ (Walker et al., 2006). A sample item is "Being a good student is an important part of who I am" (Osborne, 1997, p. 63).

[2] The original measure had a range of seven (-3 to +3) but only six response options (-3, -2, -1, 1, 2, 3), presumably to prevent neutral responses. However, the assigned point values introduce unequal intervals (i.e., the difference between the two middle options is twice that of any other pair of consecutive response options). As Mirels and Garrett (1971) offer no reason for this, and considering that all other scales used in the present study have equal intervals, responses were measured on a scale of one to six.

[3] The original IAS uses as 7-point response scale. In order to prevent neutral responding and to maintain consistency with the other scales in this experiment, a response scale of 1 to 6 was used.

2.3.9 Goal Orientation

Goal orientation was measured using the Achievement Goal Questionnaire (AGQ), which assesses the 2 x 2 achievement goal framework of Elliot and McGregor (2001). While most measures of goal orientation have used a three-factor framework consisting of performance-approach, performance-avoidance, and mastery goals, Elliot and McGregor's (2001) model divides mastery goals into mastery-approach and mastery-avoidance. The coupling of mastery and avoidance goals may seem somewhat counterintuitive, especially given that mastery goals have been associated with positive learning outcomes while avoidance goals have been associated with negative outcomes (Elliot & McGregor, 2001). However, this pairing makes sense in light of examples such as working to avoid misunderstanding, to not forget what one has learned, or to avoid making mistakes (Elliot & McGregor, 2001). This added dimension may be particularly interesting and important to the present study given that typical ASC is hypothesized to tap into an underlying drive to learn, understand, and engage with the everyday world, which may be motivated either by a desire to master or by a desire not to fail even in the absence of external performance standards. Thus, the 2 x 2 framework was assessed in this study.

The 12-item AGQ consists of four subscales: one each for performance-approach, performance-avoidance, mastery-approach, and mastery-avoidance orientations. Internal consistency reliabilities for the scales ranged from $\alpha = .83$ to $\alpha = .96$, and intercorrelations between scales ranged from $r = -.05$ to $r = .40$ in the three studies cited by Elliot and McGregor (2001). For the present study, items that are worded in the context of a single class or course (e.g., "I want to learn as much as possible from this

class"; Elliot & McGregor, 2001, p. 504) were reworded to apply to school in general ("I want to learn as much as possible in school").

2.3.10 Implicit theories of intelligence

Implicit theories of intelligence were measured using the Theories of Intelligence Scale – Self Form for Adults (TOI; Dweck, 1999). This scale assesses the respondent's belief in entity and incremental theories of intelligence, and has been reported to have excellent internal reliability (Cronbach's $\alpha = .94$ or greater in a series of six studies reported by Dweck, Chiu & Hong, 1995) and retest reliability ($\alpha = .80$; Dweck et al., 1995). Responses range from 1 (strongly disagree) to 6 (strongly agree). A sample item is "You have a certain amount of intelligence, and you really can't do much to change it" (Dweck 1999, p. 178). Because the items of this scale are highly homogeneous, they were embedded in several other measures throughout the questionnaire packet rather than presented as a group.

2.3.11 Intrinsic and extrinsic motivation

The Work Preference Inventory (WPI; Amabile et al., 1994) is a 30-item scale that assesses intrinsic and extrinsic motivation. Amabile et al. (1994) reported internal consistency reliabilities exceeding $\alpha = .70$ for both of the scales. In addition, test-retest reliability was high, ranging from $r = .84$ to $r = .94$ over six months. A representative item from the Internal Motivation scale is "I want my work to provide me with opportunities for increasing my knowledge and skills," while a representative item from the External Motivation scale is "I believe that there is no point in doing a good job if nobody else knows about it" (Amabile et al., 1994, p. 956).

2.3.12 Vocational Interest

Vocational interests were assessed using the Unisex Edition of the ACT Interest Inventory (UNIACT; Lamb & Prediger, 1981). This measure includes six interest scales comprised of 15 items each, which describe different activities; participants are asked to rate how much they would like or dislike to engage in each activity on a scale of 1 (strongly dislike) to 6 (strongly like). Internal consistency reliabilities for the six scales ranged from $\alpha = .83$ to $\alpha = .93$ in Lamb and Prediger's (1981) norming sample.

2.4 Analyses: Missing Data

In the entire set of questionnaire data, a total of three participants skipped one questionnaire item each. Because all of the items in the questionnaire were presented together and no items assessed sensitive information, these missing responses were assumed to be random oversights and their values were replaced with the mean score on the question for the entire sample.

The nine participants for whom academic data were missing were excluded from the entire analysis, because their data could not be used to assess the main hypotheses. The participant whose GPA was more than three standard deviations below the mean was excluded from all analyses as well.

CHAPTER 3

RESULTS

The results are presented in two sections. In the first section, I summarize results related to the new ASC measures themselves, including scale characteristics and factor structure. In the second section, I discuss findings regarding the nomological network of ASC – that is, the relationship of ASC composites and scales to academic indicators and other constructs assessed in the present study.

3.1 ASC Scale Characteristics and Structure

3.1.1 ASC scale characteristics

Descriptive statistics and Cronbach's α were calculated for each of the 12 ASC scales. These results are presented in Table 1. Internal consistency reliability for all ASC scales and both composites exceeded .70. Correlations between the scales and composites are presented in Table 2. Correlations between scales tapping the same domain (e.g., between maximal math and typical math) ranged from r = .46 to r = .81, suggesting that some pairs of scales differentiated between maximal and typical ASC better than others.

In order to determine whether the typical and maximal ASC true scores were differentiable (i.e., correlated less than one), the disattenuated correlation between the composites was calculated using Cronbach's α as an estimate of the reliability of the composites. This value was $r' = .97$, which suggests that the two composites were barely differentiable from each other after correcting for unreliability of measurement. However, it is likely that this is an overestimate of the true score correlation between the

Table 1

Number of Items, Means, Standard Deviations, Ranges, Internal Consistency Reliabilities, Skewness, and Kurtosis for All Measures (*N* = 210)

Scale	No. of items	*M*	*SD*	Range	α	Skewness	Kurtosis
ASC							
Max. academic	12	54.41	7.68	44.00	.86	-.29	.22
Typ. academic	15	65.52	8.39	47.00	.75	.33	.04
Max. math	15	64.97	16.20	73.00	.96	-.41	-.63
Typ. math	12	51.43	8.13	44.00	.77	-.30	.25
Max. mechanical	14	55.56	11.73	55.00	.95	-.16	-.32
Typ. mechanical	12	49.87	11.19	50.00	.91	-.32	-.38
Max. prob. solving	13	55.12	8.31	47.00	.85	-.04	-.04
Typ. prob. solving	12	51.92	7.20	38.00	.75	-.31	-.02
Max. spatial	13	49.30	9.08	52.00	.94	-.07	.04
Typ. spatial	13	57.05	10.66	54.00	.89	-.81	.52
Max. verbal	17	70.98	17.96	70.00	.95	-.26	-.89
Typ. verbal	13	55.82	9.70	50.00	.82	-.28	-.22
Max. total	[a]	0.00	3.87	20.27	.72	-.11	-.27
Typ. total	[a]	0.00	4.20	22.87	.79	-.28	.42
DPQ	9	2.02	4.43	25.00	.46	.36	.01
NEO-FFI							
Conscientiousness	12	51.46	8.56	47.00	.86	-.32	-.08
Openness	12	47.84	8.43	43.00	.74	-.06	-.25
Agreeableness	12	50.71	7.97	42.00	.79	-.32	-.29
Extroversion	12	49.63	9.13	46.00	.85	-.28	.11
Neuroticism	12	41.51	10.17	58.00	.86	.09	-.15
TIE	12	48.56	8.57	47.00	.81	-.16	.06
PES	19	77.00	8.06	47.00	.62	.16	.42
IAS	13	56.02	8.20	41.00	.75	-.20	-.28
AGQ							
Mast.-approach	3	4.63	0.80	3.67	.73	-.30	-.36
Mast.-avoidance	3	4.00	1.04	4.33	.76	-.14	-.63
Perf.-approach	3	4.27	1.25	5.00	.89	-.46	-.45
Pef.-avoidance	3	4.59	1.00	4.67	.60	-.61	-.07
TOI[b]	8	3.24	1.16	5.00	.96	.12	-.18
WPI							
Extrinsic motivation	15	60.85	8.93	59.00	.78	-.45	1.58
Intrinsic motivation	15	64.80	8.06	49.00	.80	-.12	.51

Table 1 (continued)

Scale	No. of items	*M*	*SD*	Range	α	Skewness	Kurtosis
UNIACT							
Artistic	15	53.07	15.55	75.00	.91	-.07	-.56
Investigative	15	56.35	13.99	70.00	.91	-.23	-.25
Social	15	65.45	9.82	53.00	.83	-.33	.03
Conventional	15	44.62	13.67	68.00	.91	.13	-.37
Realistic	15	50.08	11.46	65.00	.85	-.01	-.16
Enterprising	15	52.50	11.75	59.00	.87	.00	-.49
General interest	[c]	0.00	1.00	6.78		-.09	.64
Academic Measures							
Institute GPA		3.27	0.54	2.22		-.64	-.21
High School GPA[d]		3.88	0.24	1.12		-.93	.20
SAT math		697.19	64.12	260.00		-.06	-.90
SAT verbal		668.86	68.00	340.00		-.18	-.26
SAT writing		651.43	73.59	450.00		-.34	.42

Note. ASC = academic self-concept; Max. = maximal; Typ. = typical; DPQ = Defensive Pessimism Questionnaire; TIE = Typical Intellectual Engagement; PES = Protestant Ethic Scale; IAS = Identification with Academics Scale; AGQ = Achievement Goal Questionnaire; Mast.-approach = mastery approach; Perf.-approach = performance approach; TOI = Theories of Intelligence Scale; WPI = Work Preference Inventory; UNIACT = ACT Interest Inventory – Unisex Edition.

[a]Typical and maximal total scores were calculated by summing the *z*-transformations of the six typical and maximal domain scales, respectively. [b]TOI is a single scale with lower scores indicating incremental theory of intelligence and higher scores indicating entity theory of intelligence. [c]General interest score represents score on the first, unrotated factor from a factor analysis on the UNIACT. [d]Some high school GPAs exceeded 4.00.

Table 2

Correlations between Academic Self-Concept Scales

Scale	1	2	3	4	5	6	7	8	9
1. Max. total									
2. Typ. total	**.73**								
3. Max. academic	**.82**	**.50**							
4. Typ. academic	**.56**	**.81**	**.48**						
5. Max. math	**.59**	**.28**	**.52**	.07					
6. Typ. math	**.57**	**.65**	**.47**	**.40**	**.60**				
7. Max. mechanical	**.70**	**.50**	**.45**	**.26**	**.51**	**.44**			
8. Typ. mechanical	**.57**	**.68**	**.34**	**.42**	**.33**	**.45**	**.78**		
9. Max. prob. solving	**.83**	**.63**	**.66**	**51**	**.41**	**.43**	**.41**	**.37**	
10. Typ. prob. solving	**.70**	**.78**	**.51**	**.57**	**.25**	**.41**	**.38**	**.46**	**.79**
11. Max. spatial	**.72**	**.54**	**.45**	**.42**	**.25**	**.35**	**.56**	**.50**	**.48**
12. Typ. spatial	**.41**	**.72**	**.19**	**.44**	**.18**	**.39**	**.37**	**.54**	**.25**
13. Max. verbal	**.20**	**.37**	.10	**.43**	**-.40**	-.06	**-.22**	-.11	**.26**
14. Typ. verbal	**.25**	**.56**	*.14*	**.55**	**-.26**	.10	*-.14*	.00	**.31**

Note. Max. = maximal; Typ. = typical; prob. solving = problem solving. Entries significant at the $p < .05$ level are italicized. Entries significant at the $p < .01$ level are in boldface.

Table 2 (continued)

Scale	10	11	12	13
11. Max. spatial	**.44**			
12. Typ. spatial	**.40**	**.46**		
13. Max. verbal	**.36**	.04	*.14*	
14. Typ. verbal	**.45**	.10	**.25**	**.81**

composites. Cronbach's α was the only available estimate of reliability for the composites in the present study, and this statistic confounds homogeneity and reliability. As described above, the composites were calculated by summing the *z*-scores of the six scales on which each composite was based. Even within each composite, the correlations between the scale scores were not excessively high (see Table 2), indicating that the heterogeneity among the scales is artificially lowering the estimate of the reliability of the composites. In addition, the two composites differed significantly in their relationships with some other variables (discussed below and displayed in Table 3 and Table 4), indicating that there is indeed a reliable difference between the typical and maximal composites. Therefore, it is likely that the Cronbach's α coefficients have underestimated the reliability in this case, leading to over-correction of the correlation between the two composites.

The Kolmogorov-Smirnov test for normality was nonsignificant for both composites, indicating that neither the typical nor the maximal ASC distribution was significantly skewed (D = .04, p = .200 for typical; D = .04, p = .200 for maximal).

3.1.2 Confirmatory factor analysis

Hypothesis 1 was tested by conducting a confirmatory factor analysis to assess the goodness of fit of a model with two higher-order factors (one for the six typical ASC scales and one for the six maximal ASC scales, with no cross-loadings), as opposed to a model with a single higher-order factor (all 12 scales loading on a single ASC factor). The analysis was conducted in EQS Version 6.1 for Windows, using a covariance matrix obtained using SPSS. Results are presented in Table 5.

Table 3

Correlations between ASC Composites and Other Self-Report Scales

Measure	Correlations		T_2
	Max. ASC	Typ. ASC	
NEO-FFI			
Conscientiousness	**.34**	**.29**	-0.93
Openness	**.27**	**.32**	0.97
Agreeableness[a]	-.04	.05	1.73
Extroversion[a]	.10	*.20*	*2.00*
Neuroticism[a]	**-.35**	**-.34**	0.19
PES	**.18**	**.17**	-0.12
TIE	**.47**	**.53**	1.58
IAS	**.28**	.10	**-3.77**
AGQ			
Mastery-approach	**.30**	**.26**	-0.82
Mastery-avoidance[a]	.02	.06	0.78
Performance-approach[a]	*.17*	-.02	**-3.87**
Performance-avoidance[a]	-.09	-.12	-0.63
TOI	-.08	-.05	0.45
WPI			
Intrinsic	**.61**	**.60**	-0.18
Extrinsic[a]	-.01	**-.24**	**4.63**

Note. Max. = maximal; Typ. = typical; PES = Protestant Ethic Scale; TIE = Typical Intellectual Engagement; IAS = Identification with Academics Scale; AGQ = Achievement Goal Questionnaire; TOI = Theories of Intelligence Scale; WPI = Work Preference Inventory. Entries significant at the $p < .05$ level are italicized. Entries significant at the $p < .01$ level are in boldface.

[a]Exploratory analysis.

Table 4

Correlations between ASC Composites/Scales and Academic Indicators

	Institute GPA			SAT Math		
ASC Scale	Max.	Typ.	T_2	Max.	Typ.	T_2
Total	**.26**	-.04	**-6.50**	*.15*	-.09	**-4.94**
Academic[a]	**.44**	-.05	**-8.18**	**.24**	*-.14*	**-5.73**
Math[a]	**.30**	.10	**-3.37**	**.35**	*.14*	**-3.67**
Mechanical[a]	.08	-.10	**-3.96**	.13	.02	**-2.46**
Problem Solving[a]	**.18**	.07	**-2.54**	.09	-.02	-0.25
Spatial[a]	.10	-.09	**-2.68**	.10	*-.17*	**-3.82**
Verbal[a]	-.08	-.09	-0.14	**-.34**	**-.21**	**3.22**

Note. Max. = Maximal; Typ. = Typical. Entries significant at the $p < .05$ level are italicized. Entries significant at the $p < .01$ level are in boldface.
[a]Exploratory analysis.

Table 4 (continued)

	SAT Verbal			SAT Writing		
ASC Scale	Max.	Typ.	T_2	Max.	Typ.	T_2
Total	.09	.02	-1.27	.07	-.06	**-2.57**
Academic[a]	*.15*	.12	-0.45	*.18*	-.02	**-2.83**
Math[a]	-.07	.00	1.09	-.01	-.03	-0.32
Mechanical[a]	-.11	*-.15*	-1.03	-.09	*-.17*	-1.74
Problem Solving[a]	.09	-.02	**-2.34**	.03	-.02	-0.97
Spatial[a]	.00	*-.14*	-1.93	-.04	**-.21**	**-2.38**
Verbal[a]	**.28**	**.28**	0.00	**.20**	**.19**	-0.36

Table 5

Fit Indices for Nested Sequences of Factor Models

Model	χ^2	df	CFI	RMSEA	$\Delta\chi^2$
1. 1 factor, uncorrelated errors	**1004.13**	54	.41	.29	
2. 2 factors, uncorrelated errors	**862.49**	53	.49	.27	
Model 1 - Model 2					**141.64**
3. 1 factor, correlated errors	**435.56**	48	.76	.20	
Model 1 - Model 3					**568.57**
4. 2 factors, correlated errors	**319.31**	47	.83	.17	
Model 1 and Model 4					**684.82**
Model 2 and Model 4					**543.18**
Model 3 and Model 4					**116.25**

Note. Entries significant at the $p < .05$ level are italicized. Entries significant at the $p < .01$ level are in boldface.

The one-factor model was tested first. In this model, all 12 ASC scales load on a single ASC factor. In the initial run, all error correlations were set to zero. This model fit the data poorly (CFI = .41; RMSEA = .29). The two-factor model was tested next. In this model, the six typical ASC scales load on a typical ASC factor, and the six maximal ASC scales load on a maximal ASC factor. All cross-factor loadings were set to zero, as were all error correlations. The two factors were allowed to correlate. The fit for this model was also poor (CFI = .49; RMSEA = .27).

The Lagrange Multiplier Test indicated that several error terms were correlated with each other, and that allowing them to correlate would lead to better model fit. Based on this information, the error terms of same-domain scales were allowed to correlate with each other – that is, typical math ASC error was allowed to correlate with maximal math ASC error, and so on for each of the six pairs of scales. The fit for this model was significantly better than the fit for the previous two-factor model ($\Delta\chi^2 = 543.18$, $\Delta df = 6$; $p < .05$), but still did not reach the threshold of acceptable fit (CFI = .83; RMSEA = .17).

Because no additional changes to the model could be justified by theory, no further adjustments were made.

However, the question remained whether the two-factor model with correlated errors fit the data better than a one-factor with correlated errors. It was possible that the superiority of the two factor model came entirely from the correlated errors, not from the inclusion of two-factors. To test this possibility, fit indices were calculated for a one-factor model with correlated errors. Not surprisingly, the fit for this model was also poor; however, and most relevantly, it fit the data significantly more poorly than the two-factor, correlated errors model ($\Delta \chi^2 = 116.25$, $\Delta df = 1$; $p < .05$), indicating that the two-factor model represented a true improvement over the one-factor model.

3.2 Nomological Network

Descriptive statistics for all measures used in this study, including academic data, are presented in Table 1. Correlations between non-ASC measures appear in Table 6.

3.2.1 Relationship with academic data

To test Hypothesis 2, a Williams's T_2 test was used to compare the correlation between typical ASC and Institute GPA to the correlation between maximal ASC and Institute GPA. Contrary to expectation, the maximal ASC—GPA relationship ($r = .26$, $p < .001$) was significantly stronger than the typical ASC—GPA relationship ($r = -.04$, $p = .589$; $T_2 = -6.51$, $p < .05$).

Hypothesis 3 was tested using linear regression. Given that high school GPA and SAT scores are already widely used to predict college GPA, they were entered first so that the usefulness of adding ASC to the currently used method could be assessed. Thus,

Table 6

Correlations between Self-Report Measures and Academic Indicators

Scale	1	2	3	4	5	6	7	8	9	10
1. SAT math										
2. SAT verbal	**.33**									
3. SAT writing	**.41**	**.60**								
4. High School GPA	.13	**.30**	**.35**							
5. Institute GPA	**.30**	**.20**	**.29**	**.37**						
6. Realistic	.10	-.10	-.06	.03	-.09					
7. Investigative	.13	.02	.04	.08	.00	**.45**				
8. Artistic	.00	.12	**.18**	*.14*	.01	**.31**	**.26**			
9. Social	-.08	.01	.11	.01	-.02	*.17*	.12	**.37**		
10. Enterprising	-.05	-.01	.03	.00	-.04	.05	**-.21**	.09	**.48**	
11. Conventional	.12	.02	.01	.09	.05	**.44**	.05	-.03	.09	**.47**
12. Perf.-avoidance	**-.18**	*-.14*	-.09	-.11	-.05	-.06	-.04	-.03	.00	-.05
13. Perf-approach	.07	.11	.05	.07	**.35**	-.05	.07	.14	-.10	-.02
14. Mast.-avoidance	.01	.04	.04	*.18*	**.21**	*.15*	**.23**	**.24**	**.19**	*.16*
15. Mast.-approach	.06	.00	.04	.13	.00	*.15*	**.26**	**.19**	.09	.04
16. IAS	*.16*	.11	*.17*	**.31**	**.57**	-.03	*.14*	.04	.10	.07
17. Neuroticism	-.04	.01	.12	-.01	-.02	-.03	.09	.11	-.07	**-.20**
18. Extroversion	-.04	-.02	-.05	-.06	.03	-.12	-.08	-.06	**.42**	**.45**
19. Openness	.07	**.27**	*.18*	.04	-.01	*.15*	**.36**	**.51**	**.22**	-.04
20. Agreeableness	**-.20**	-.03	-.10	.10	-.05	-.08	.00	.07	**.23**	-.05
21. Conscientious.	-.12	-.06	-.02	**.21**	**.24**	-.05	-.08	**-.19**	.04	.13
22. PES	.09	.03	.09	*.15*	.09	.01	.08	-.03	.01	.01
23. TIE	.00	**.19**	.04	.00	.00	.11	*.16*	**.22**	**.22**	**.20**
24. Intrinsic motivat.	.04	.00	-.05	-.01	.07	**.23**	*.15*	**.23**	**.18**	**.15**
25. Extrinsic motivat.	.03	.02	.12	.04	**.32**	*-.17*	-.03	-.11	-.11	-.06
26. TOI	.07	.06	.09	-.12	-.04	.06	.11	.07	-.08	-.13

Note. Perf.-avoidance = performance-avoidance; Perf.-approach = performance approach; Mast.-avoidance = mastery avoidance; Mast.-approach = mastery approach; IAS = Identification with Academics Scale; Conscientious. = consciousness; PES = Protestant Ethic Scale; TIE = Typical Intellectual Engagement; Intrinsic motivat. = intrinsic motivation; Extrinsic motivat. = extrinsic motivation; TOI = Theories of Intelligence. Entries significant at the $p < .05$ level are italicized. Entries significant at the $p < .01$ level are in boldface.

Table 6 (continued)

Scale	11	12	13	14	15	16	17	18	19	20
12. Perf.-avoidance	-.08									
13. Perf-approach	-.02	.11								
14. Mast.-avoidance	**.22**	-.05	*.17*							
15. Mast.-approach	.05	.06	.04	**.50**						
16. IAS	.13	-.12	**.40**	**.40**	.12					
17. Neuroticism	.01	**.23**	.08	.02	*.17*	.03				
18. Extroversion	.05	.01	.07	.09	-.07	.05	**-.32**			
19. Openness	-.01	-.08	-.10	*.14*	**.20**	.02	.00	.08		
20. Agreeableness	-.13	.07	*-.17*	.05	.03	.00	**-.22**	**.24**	.10	
21. Conscientious.	**.18**	.09	**.26**	**.37**	.07	**.40**	**-.21**	*.18*	**-.20**	**.26**
22. PES	.08	.01	.12	**.28**	*.18*	**.26**	-.04	.03	*-.17*	-.05
23. TIE	**.18**	**-.22**	-.04	**.32**	.11	**.23**	*-.16*	.08	**.49**	-.06
24. Intrinsic motivat.	*.16*	-.10	.03	**.46**	**.28**	**.18**	**-.27**	.14	**.40**	.04
25. Extrinsic motivat.	-.12	**.26**	**.61**	.11	.04	**.37**	**.29**	.07	*-.18*	-.10
26. TOI	-.07	.12	.06	*-.16*	*-.18*	**-.21**	*.17*	*-.16*	.00	*-.14*

Table 6 (continued)

Scale	21	22	23	24	25
22. PES	**.31**				
23. TIE	.06	.05			
24. Intrinsic motivat.	**.22**	**.22**	**.58**		
25. Extrinsic motivat.	*.15*	**.19**	*-.18*	**-.20**	
26. TOI	**-.24**	-.10	*-.14*	*-.14*	.04

SAT total scores and high school GPA were added in the first step, followed by maximal ASC and typical ASC together in the second step. R^2 change for each step was significant (see Table 7), indicating that typical and maximal ASC together accounted for variance in Institute GPA above and beyond the variance predicted by SAT scores and high school GPA.

Table 7

First Hierarchical Regression Predicting Institute GPA from SAT, High School GPA, Maximal ASC, and Typical ASC

Predictors	R^2	ΔR^2	*B*	*SE B*	β
Step 1	**.187**	**.187**			
Total SAT			**.001**	.000	**.244**
High school GPA			**.664**	.150	**.292**
Step 2	**.299**	**.111**			
Total maximal ASC			**.070**	.012	**.500**
Total typical ASC			**-.052**	.011	**-.405**

Note. Entries significant at the $p < .05$ level are italicized. Entries significant at the $p < .01$ level are in boldface.

Ideally, variables are entered into linear regression models in causal order (Cohen, Cohen, West, & Aiken, 2003). The order of the variables in the analysis described above was determined by the fact that the usefulness of typical and maximal ASC must be considered in the context of the current college admissions process. However, given evidence that ASC affects later academic achievement (Marsh et al., 2005; Marsh & Yeung, 1997), a second linear regression analysis was conducted entering typical ASC first, followed by maximal ASC in the second step, and SAT score and high school GPA in the third. This second analysis was intended to test whether the sr^2 of both SAT and

high school GPA would be reduced using this ordering of variables, which would indicate that SAT and high school GPA are better conceptualized as partial mediators between ASC and Institute GPA rather than pure predictors in their own right. Results of this analysis are presented in Table 8. R^2 change for the first step was not significant, between ASC and Institute GPA rather than pure predictors in their own right. Results of this analysis are presented in Table 8. R^2 change for the first step was not significant, indicating that typical ASC does not account for a significant portion of the variance in Institute GPA. However, R^2 change for both the second and third steps were significant, indicating that maximal ASC predicts a significant proportion of the variance in Institute GPA, and that, together, SAT score and high school GPA account for additional variance in Institute GPA above and beyond that accounted for by maximal ASC.

Table 8

Second Hierarchical Regression Predicting Institute GPA from Typical ASC, Maximal ASC, SAT, and High School GPA

Predictors	R^2	ΔR^2	*B*	*SE B*	β
Step 1	.001	.001			
Total maximal ASC			-.005	.009	-.038
Step 2	**.182**	**.181**			
Total maximal ASC			**.086**	.013	**.620**
Step 3	**.299**	**.116**			
Total SAT			**.001**	.000	**.169**
High School GPA			**.595**	.141	**.261**

Note. Entries significant at the $p < .05$ level are italicized. Entries significant at the $p < .01$ level are in boldface.

The negligible correlation between typical ASC and Institute GPA observed in the test of Hypothesis 2 was unexpected, so exploratory analyses were conducted to further investigate the relationship between ASC and academic outcomes. As these analyses were not proposed a priori, the following results should be interpreted with caution.

A T_2 test (described above) had already determined that the maximal ASC composite was significantly more strongly correlated with Institute GPA than was the typical ASC composite. Additional T_2 tests were conducted to compare the correlations between the typical ASC composite and the three SAT scores, and between the maximal ASC composite and the SAT scores. Only one of these correlations was significantly different from zero: the correlation between maximal ASC and SAT math (r = .15, p = .032). This correlation was significantly stronger than the correlation between typical ASC and SAT math (r = -.09, p = .187; T_2 = -4.94, p < .05).

Both the typical ASC and maximal ASC composites are heterogeneous (i.e., they are composites of scales measuring ASC in six different domains). Therefore it is possible that one or more of the domain scales may predict Institute GPA better than the composites, especially at a math and science intensive school such as Georgia Tech. In addition, the math and verbal scales may be better predictors of SAT math and verbal scores, respectively, due to their domain specificity. To test these possibilities, correlations between the domain scales and academic indicators were calculated. Results are presented in Table 4. No typical domain scales were significantly correlated with Institute GPA. Of the maximal domain scales, academic, math, and problem solving were significantly correlated with Institute GPA. Williams's T_2 tests revealed that for all domains except verbal, the correlations were significantly stronger for the maximal scales

than for the typical scales for the same domain. The difference between the verbal scales was not significant.

This process was repeated for SAT math, verbal, and writing scores. Results are displayed in Table 4, and the findings of most theoretical interest are highlighted here. Maximal academic ASC was significantly correlated with all three SAT scores (r = .24, p < .001 for SAT math; r = .15, p = .032 for SAT verbal; r = .18, p = .007 for SAT writing). It was significantly stronger than the correlation between typical academic ASC and the SAT scores for both SAT math and SAT writing. Maximal math ASC was significantly correlated with SAT math (r = .35, p < .001) but not with SAT verbal (r = -.07, p = .299) or SAT writing scores (r = -.01, p = .947). Typical math ASC also was correlated with SAT math (r = .14, p = .042), but significantly less strongly than was maximal math ASC (r = .35, p < .001; T_2 = -3.67, p < .05). Both typical and maximal verbal ASC were significantly correlated with both SAT verbal (r = .28, p < .001 for maximal; r = .28, p < .001 for typical) and SAT writing scores (r = .20, p = .004 for maximal; r = .19, p = .007 for typical), and these correlations did not differ significantly (T_2 = 0.00, *ns* for SAT verbal; T_2 = -0.36, *ns* for SAT writing). Both verbal ASC scales were negatively correlated with SAT math score (r = -.34, p < .001 for maximal verbal; r = -.21, p = .002 for typical verbal), and the difference between these correlations was significant (T_2 = 3.22, p < .05).

3.2.2 Expected sources of group differences in ASC

I had predicted that defensive pessimists would have lower maximal ASC than their peers who do not engage in defensive pessimism (Hypothesis 4). Norem and Illingworth (1993) classified participants as defensive pessimists based on two criteria.

First, a participant's score on the DPQ must have fallen into the top quartile of the sample. Second, the participant must have responded with a 7 or above (on an 11-point scale) to the item "I've generally done pretty well in academic situations in the past" (Norem & Illingworth, 1993, p. 825). Because the present study used a 6-point scale for all measures, a minimum score of 5 on that item was used as the cutoff in determining membership in the defensive pessimism group. This resulted in 47 (22.4%) participants being classified as defensive pessimists, with the remaining 163 (77.6%) participants classified as non-defensive pessimists. Mean ASC composite scores for the two groups were compared using *t*-tests. No significant differences between the two groups were found for either maximal ASC ($t(208) = 0.03$, $p = .977$) or typical ASC ($t(208) = 0.49$, $p = .623$).

Year in college also was expected to moderate the relationship between maximal ASC and college GPA, with more years in college being associated with a higher maximal ASC; this hypothesis (Hypothesis 5a) was tested using paired comparisons after determining year in college based on number of college credit hours completed as of the end of the fall 2012 semester (0-29 credit hours = freshman; 30-59 = sophomore; 60-89 = junior; 90+ = senior). None of the comparisons were significant (see Table 9). I had also predicted that the correlation between maximal ASC and college GPA would increase with more years in college (Hypothesis 5b). Results were mixed and did not show a linear increase: $r = .11$, $p = .476$ for freshmen, $r = .31$, $p = .010$ for sophomores, $r = .18$, $p = .302$ for juniors, and $r = .40$, $p = .002$ for seniors. The strengths of these correlations were compared using Fisher's *z*-transformations, and results of these comparisons are presented in Table 9.

Table 9

Differences in Maximal ASC by Year in College

	Mean differences		Correlation differences
Comparison	*t*	*d*	*z*
Freshman vs. Sophomore	-0.27	-0.05	1.10
Freshman vs. Junior	0.33	0.08	0.34
Freshman vs. Senior	0.80	0.16	1.55
Sophomore vs. Junior	0.62	0.13	-0.62
Sophomore vs. Senior	1.18	0.21	-0.54
Junior vs. Senior	0.40	0.08	-1.04

Note. All *t*-values and *z*-values are non-significant.

Table 10

Gender Differences in Mean ASC by Scale

	Men[a]		Women[b]			
Scale	*M*	*SD*	*M*	*SD*	*t*	*d*
Max. total[c]	1.06	3.88	-0.88	3.65	*3.73*	0.50
Typ. total[c]	0.92	3.82	-0.76	4.37	*2.93*	0.40
Max. academic[c]	56.45	7.26	52.73	7.64	*3.59*	0.48
Typ. academic[c]	66.85	8.21	64.42	8.42	*2.11*	0.29
Max. math	68.92	15.50	61.70	16.11	*3.29*	0.45
Typ. math	52.84	7.77	50.27	8.27	*2.31*	0.31
Max. mechanical	59.60	11.47	52.21	10.90	*4.77*	0.63
Typ. mechanical	54.31	10.39	46.20	10.52	*5.59*	0.72
Max. problem solving[c]	57.08	8.51	53.48	7.81	*3.20*	0.43
Typ. problem solving[c]	53.08	7.20	50.96	7.09	*2.11*	0.30
Max. spatial	50.83	9.12	48.04	8.89	*2.24*	0.31
Typ. spatial	58.66	9.72	55.71	11.25	*2.01*	0.28
Max. verbal	67.47	17.60	73.88	17.80	*-2.61*	-0.36
Typ. verbal	54.62	9.59	56.81	9.72	-1.63	-0.23

Note: Max. = maximal; Typ. = typical. Entries significant at the $p < .05$ level are italicized. Entries that remained significant after Bonferroni correction are underlined.
[a]$n = 95$. [b]$n = 115$. [c]Exploratory analysis.

3.2.3 Gender differences

I stated two hypothesis regarding gender differences in ASC scales: first, that men would have higher scores for both the typical and maximal scales for math, spatial and mechanical ASC scales (Hypothesis 6a), and second, that women would have higher scores on the typical and maximal verbal ASC scales (Hypothesis 6b). A series of *t*-tests was used to test for gender differences on these scales. Mean gender differences were all in the expected direction, but after correcting for multiple tests using the Bonferroni method, only three comparisons were significant: maximal math ($t(208) = 3.29$, $p < .001$, $d = 0.45$), maximal mechanical ($t(208) = 4.77$, $p < .001$, $d = 0.63$), and typical mechanical ($t(208) = 5.59$, $p < .001$, $d = 0.72$). Results are displayed in Table 10.

Additional exploratory analyses were conducted to examine whether gender differences were observed in the remaining ASC scales and in the composites. These results are included in Table 10. Men scored higher on all scales and composites assessed in this exploratory analysis, and four of the comparisons remained significant following Bonferroni correction: maximal academic ($t(208) = 3.59$, $p < .001$, $d = 0.48$), maximal problem solving ($t(208) = 3.20$, $p = .002$, $d = 0.43$), and both the typical and maximal composites ($t(208) = 2.93$, $p = .004$, $d = 0.40$ for typical; $t(208) = 3.73$, $p < .001$, $d = 0.50$ for maximal).

As described above, the ASC scales and composites varied in their correlations with Institute GPA. In light of the gender differences in ASC scores, the correlations between the ASC scales/composites were re-analyzed for each gender separately, in order to test whether these correlations differed between the genders. Correlations are presented in Table 11. The correlations were compared using a Fisher's *z*-transformation

Table 11

Correlations between ASC Scales and Academic Indicators by Gender

	Men[a]			
Scale	Inst.GPA	SAT math	SAT verbal	SAT writing
Max. total	*.26*	.14	.01	.01
Typ. total	-.01	-.02	.01	-.07
Max. academic	**.47**	*.21*	-.02	.06
Typ. academic	.03	-.05	.11	-.01
Max. math	*.26*	**.31**	-.16	-.11
Typ. math	.09	.12	-.07	-.15
Max. problem solving	*.25*	.11	.06	.08
Typ. problem solving	.17	.09	-.01	.06
Max. verbal	.04	-*.21*	**.39**	*.22*
Typ. verbal	-.01	.00	**.43**	*.24*

Note. Inst. = Institute; Max. = maximal; Typ. = typical. Entries significant at the $p < .05$ level are italicized. Entries significant at the $p < .01$ level are in boldface. Four correlations significantly differed across genders: max. academic and SAT verbal, max. academic and SAT writing, typical verbal and SAT math, and typical verbal and SAT verbal.

[a]$n = 95$. [b]$n = 115$

Table 11 (continued)

	Women[b]			
Scale	Inst.GPA	SAT math	SAT verbal	SAT writing
Max. total	**.32**	.08	.18	.21
Typ. total	-.04	-*.21*	.04	.00
Max. academic	**.48**	*.20*	**.32**	**.37**
Typ. academic	-.11	**-.26**	.14	.02
Max. math	**.37**	**.34**	.02	.14
Typ. math	.13	.11	.06	.12
Max. problem solving	.15	.01	.14	.06
Typ. problem solving	-.03	-.15	-.02	-.04
Max. verbal	-*.21*	**-.40**	.17	.13
Typ. verbal	-.17	**-.34**	.14	*.21*

(not presented). Only four of the correlations differed across genders: maximal academic and SAT verbal (r = -.02, p = .887 for men; r = .32, p < .001 for women; T_2 = 2.45, p < .05), maximal academic and SAT writing (r = .06, p = .582 for men; r = .37, p < .001 for women; T_2 = 2.32, p < .05), typical verbal and SAT math (r = .00, p = .979 for men; r = -.34, p < .001 for women; T_2 = -2.51, p < .05), and typical verbal and SAT verbal (r = .43, p < .001 for men; r = .14, p = .126 for women; T_2 = -2.27, p < .05).

Prior work has suggested that on self-report measures of ability, men tend to overclaim their levels of ability, while women tend to underclaim (Furnham, Hosoe, & Tang, 2001). However, Furnham, Hosoe, et al. (2001) did not assess ability directly; therefore, it is possible that men's higher claims of ability are due to gender differences in actual ability and thus do not represent overclaiming. Although the present study was not designed to test this hypothesis, this possibility was assessed indirectly by comparing the effect sizes of the gender differences in ASC to the effect sizes of the gender differences in the three SAT scores (math, verbal, and writing). Because the SAT scores are domain-specific and are obtained under maximal environmental pressure, only the maximal math and verbal ASC scales were used in this analysis. For math, d = 0.38 for SAT math, and d = 0.44 for maximal math ASC, with the mean score for men being higher on both. Verbal abilities were measured by both SAT verbal (d = -0.07) and SAT writing (d = -0.35); for maximal verbal ASC, d = -0.35. Thus, there was reasonable agreement between the effect sizes for math ASC and math ability as measured by the SAT math score, and there was close agreement between the effect sizes for verbal ability (as measured by SAT writing, but not by SAT verbal) and verbal ASC.

3.2.4 Relationships between ASC and other constructs

Several other relationships between the new ASC composites and existing measures were predicted. These hypotheses (Hypotheses 7a through 13) were tested using Williams's T_2 tests to compare the strength of the correlations between typical ASC and other measures, versus the strength of the correlation between maximal ASC and the same measures. These results are presented in Table 3. The correlation between maximal ASC and Identification with Academics (r = .28, p < .001) was significantly stronger than the correlation between typical ASC and Identification with Academics (r = .10, p = .169; T_2 = -3.77, p < .01), providing support for Hypothesis 10. The differences between correlations for conscientiousness, openness, TIE, Protestant work ethic, mastery-approach goal orientation, theories of intelligence, and intrinsic motivation were not significant; thus, Hypotheses 7a, 7b, 8, 9, 11, 12, and 13 were not supported.

Several of the measures used in the analyses above included subscales that did not form the basis for any hypotheses. On an exploratory basis, correlations between the ASC composites and these additional subscales were computed and compared. Results are included in Table 3. Maximal ASC was significantly more highly correlated with a performance-approach goal orientation as measured by the AGQ (r = .17, p = .013 for maximal; r = .020, p = .778 for typical; T_2 = -3.87, p < .01). Typical ASC was significantly more strongly (negatively) correlated with extrinsic motivation as measured by the WPI (r = -.01, p = .858 for maximal; r = -.24, p < .001 for typical; T_2 = 4.63, p < .01). Extroversion was significantly more highly correlated with typical ASC (r = .20, p = .003) than with maximal ASC (r = .10, p = .142; T_2 = 2.00, p < .05). Results for

neuroticism, agreeableness, mastery-avoidance orientation, and performance-avoidance orientation were not significant.

In Hypothesis 14a, I had predicted that typical ASC would be significantly correlated with investigative, artistic, and social career interests, but not with the other career interests as measured by the UNIACT. I did not predict that maximal ASC would correlate significantly with any of the career interest areas. This hypothesis was partially supported: for investigative, artistic, and social interests, the correlations with typical ASC were significant while the correlations with maximal ASC were not. However, for the remaining career interest areas (realistic, enterprising, and conventional), correlations with both the typical and maximal ASC composites all were significant except for the correlation between enterprising and maximal ASC. These results are included in Table 12.

In Hypothesis 14b, I had predicted that typical ASC, but not maximal ASC, would be significantly correlated with the general interest factor of the UNIACT. The general interest factor emerges as the first factor when a factor analysis of UNIACT data is performed (Darcy & Tracey, 2003). Following Prediger (1982), an unrotated factor solution was obtained so as not to distribute the general interest variance across the six interest factors. The first factor accounted for 13.6% of the variance. Individual participants' scores on this factor were computed and correlated with maximal and typical ASC. Both correlations were significantly different from zero (maximal: $r = .25$, $p < .001$; typical: $r = .37$, $p < .001$) and these correlations were significantly different from each other ($T_2 = 2.71$, $p < .05$). Thus, Hypothesis 14b was supported.

Table 12

Correlations between ASC Scales and Other Self-Report Measures

	Total		Academic		Math		Mechanical	
Scale	Max.	Typ.	Max.	Typ.	Max.	Typ.	Max.	Typ.
Realistic	**.26**	**.32**	*.14*	*-.16*	*.16*	**.22**	**.49**	**.63**
Investig.	.11	**.19**	.11	**.27**	.08	.12	**.25**	**.31**
Artistic	.09	**.18**	.09	**.26**	-.13	-.10	.00	.05
Social	.04	**.22**	.01	**.25**	-.12	.06	-.07	.04
Enterpris.	.10	*.18*	.11	*.18*	-.03	.10	-.04	.04
Conven.	**.21**	**.23**	**.22**	.10	*.17*	**.35**	*.15*	**.23**
Perf.-av.	-.09	-.12	-.12	-.11	-.02	-.11	.00	-.08
Perf.-app.	*.17*	-.02	**.24**	-.02	*.14*	.08	*.14*	-.01
Mast.-app.	**.30**	**.26**	**.34**	**.29**	**.20**	**.25**	**.26**	*.16*
Mast.-av.	.02	.06	.05	.12	-.01	.04	.11	.11
IAS	**.28**	.10	**.39**	.08	**.26**	*.18*	*.15*	.02
Neurot.	**-.35**	**-.34**	**-.22**	**-.30**	**-.25**	**-.23**	**-.22**	**-.26**
Extrovers.	.10	**.20**	.04	**-.18**	.04	.09	.01	-.01
Openness	**.27**	**.32**	**.22**	**.44**	-.04	.11	.05	.10
Agreeab.	-.04	.05	-.06	.11	-.09	-.02	-.08	-.04
Conscient.	**.34**	**.29**	**.29**	*.16*	**.22**	**.26**	**.23**	**.18**
PES	**.18**	*.17*	*.14*	.10	.11	.12	**.22**	**.18**
TIE	**.47**	**.53**	**.36**	**.52**	.09	**.35**	*.16*	**.26**
Int. motiv.	**.61**	**.60**	**.49**	**.53**	**.30**	**.44**	**.41**	**.43**
Ext. motiv.	-.01	**-.24**	.11	*-.15*	.02	-.12	.01	**-.20**
TOI	-.08	-.05	-.09	-.07	-.02	.03	-.04	-.04

Note. Max. = maximal; Typ. = typical; Investig. = investigative; Enterpris. = enterprising; Conven. = conventional; Perf.-av. = performance-avoidance; Perf.-app. = performance-approach; Mast.-app. = mastery-approach; Mast.-avoid = mastery-avoidance; IAS = Identification with Academics Scale; Neurot. = neuroticism; Extrovers. = extroversion; Agreeab. = agreeableness; Conscient. = conscientiousness; PES = Protestant Ethic Scale; TIE = Typical Intellectual Engagement; Int. motiv. = intrinsic motivation; Ext. motiv. = extrinsic motivation; TOI = Theories of Intelligence. Entries significant at the $p < .05$ level are italicized. Entries significant at the $p < .01$ level are in boldface.

Table 12 (continued)

	Prob. Solv.		Spatial		Verbal	
Scale	Max.	Typ.	Max.	Typ.	Max.	Typ.
Realistic	.12	*.16*	**.30**	**.24**	**-.20**	-.07
Investig.	-.02	.06	.13	.07	-.11	-.02
Artistic	.04	*.14*	.11	.08	**.26**	**.34**
Social	.09	**.18**	.06	.12	**.19**	**.26**
Enterpris.	*.15*	**.20**	.04	.06	*.16*	*.17*
Conven.	*.17*	**.19**	*.16*	.11	-.05	-.01
Perf.-av.	-.12	*-.14*	-.06	-.02	-.05	-.08
Perf.-app.	.12	.03	.08	-.04	-.05	-.12
Mast.-app.	**.18**	**.28**	**.21**	.06	-.02	.07
Mast.-av.	-.07	.00	.08	.01	-.08	-.02
IAS	**.20**	*.16*	.07	-.04	.02	.01
Neurot.	**-.31**	**-.26**	**-.28**	**-.27**	-.07	-.10
Extrovers.	*.15*	**.22**	.01	.13	*.16*	**.24**
Openness	**.28**	**.29**	**.21**	.05	**.33**	**.35**
Agreeab.	-.05	-.03	.04	.08	.11	.11
Conscient.	**.24**	**.30**	**.25**	**.25**	.07	.07
PES	.08	**.20**	*.16*	*.14*	-.01	-.01
TIE	**.51**	**.54**	**.32**	*.15*	**.37**	**.43**
Int. motiv.	**.55**	**.61**	**.47**	**.29**	.12	**.23**
Ext. motiv.	-.03	*-.15*	-.05	**-.24**	-.10	*-.15*
TOI	-.11	-.12	-.04	-.03	.01	.01

In an attempt to gain an overall sense of the relationships between the ASC scales and other constructs, correlations between all ASC scales and the other measures used in this study were calculated on an exploratory basis. These results are presented in Table 12. From these results, some general observations can be made. Intrinsic motivation had moderate correlations with nearly all ASC scales and composites, with some correlations exceeding $r = .50$. Typical intellectual engagement and conscientiousness were significantly positively correlated with nearly all of the scales, while neuroticism was significantly negatively correlated with nearly all of the scales. Realistic vocational interest was significantly correlated with many, and conventional interest was correlated

with most of the ASC scales. Extrinsic motivation tended to be significantly negatively correlated with typical ASC scales, but not with maximal ASC scales. Conversely, identification with academics tended to have significant positive relationships with the maximal ASC scales, but not with the typical ASC scales. Overall, the two verbal ASC scales had a greater number of near-zero correlations with other measures compared to the other ASC scales, indicating that the verbal ASC scales are less strongly related to other measures in the study compared to the other ASC scales.

3.3 Summary of Results

Although many of the hypotheses were not supported, some interesting results were revealed by exploratory analyses. The main hypothesis that Institute GPA would be more strongly correlated with the typical ASC composite than the maximal ASC composite was not supported: the typical ASC composite was not correlated with Institute GPA, but the maximal ASC composite was significantly correlated with GPA. In general, domain-specific maximal (and, to a lesser degree, typical) ASC scales exhibited stronger relationships with academic outcomes compared to the composites. In addition, gender differences were observed in ASC scales and composites as well as in the academic data. These results suggest directions for future research, as described below.

CHAPTER 4

DISCUSSION

This study applied the typical/maximal framework to ASC in an attempt to increase its predictive validity for academic outcomes. The results described here offer only limited support for this particular instantiation of a typical/maximal ASC measure, at least at the level of the composites. However, the analyses did yield some interesting results deserving of consideration. This discussion is presented in two sections. In the first section, I address ASC scale relationships and structure, and the second section I address gender differences.

4.1 ASC Scales and Composites

4.1.1 Relationships between ASC scales and composites

As expected, the maximal and typical ASC composites correlated highly with each other, but most of the expected differences in their relationships with other constructs did not materialize. In many cases, the typical and maximal composites did not relate differentially to the other measures. The high correlation between the typical and maximal ASC composites themselves likely played a role in these null results. The observed correlation between the two composites was $r = .73$, but the disattenuated correlation was $r' = .97$. This may indicate that ASC in typical and maximal pressure situations is not meaningfully different, or it may indicate that this measure was not successful in distinguishing between the two. However, as noted above, it is likely that the Cronbach's α coefficient underestimated the reliability of the composites, leading to overcorrection of the disattenuated correlation.

Interestingly, at the domain level, not all of the correlations were excessively high. Typical-maximal correlations for three of the domains (verbal, problem solving, and mechanical) exceeded $r = .78$, but the remaining three were much more moderate ($r < .60$). This suggests several possibilities. It may be that the scales for the highly correlated domains were not well constructed. The six maximal scales were quite similar to each other, with many items nearly identical in all scales except for the name of the domain inserted into the item (see Appendix). Given this consistency in the maximal scales, then, differences in the typical-maximal correlations could have arisen from characteristics of the typical scales, or from the (relatively few) unique items that appeared in the maximal scales. It is possible that some feature(s) of the typical verbal, problem solving, and mechanical scales made them more similar to their respective maximal scales, while some feature(s) of the typical math, academic, and spatial scales made them more different from their maximal counterparts. It is difficult to speculate about what these features may be. The typical verbal and problem solving scales contain several items that explicitly specify non-maximal performance (e.g., "I can write effectively when I am writing a note *to a friend*"; emphasis added), which would seem to suggest that these scales would yield the best discrimination between typical and maximal contexts. By contrast, the typical academic, math, and spatial scales include more items describing specific behaviors that did not need to specified as typical (e.g., "I like playing games like Trivial Pursuit"). Perhaps this contributed to the differences in the correlations by creating different frames of reference or having subtly different levels of specificity.

Another possibility is that it is difficult to distinguish between typical and maximal performance in the verbal, problem solving, and mechanical domains. Perhaps the explicit wording of the typical verbal and problem solving scales simply indicates that generating typical items in these domains was particularly difficult, and the explicitness of the items represents an attempt to establish an artificial dichotomy between typical and maximal situations in those areas. It is possible that in these domains, people tend to perform near their peak level in most situations, regardless of environmental pressures; or, put another way, that people do not generally see themselves as capable of performing at a higher level than their usual level in these domains, even when the situation demands it. Perhaps people do not see themselves as keeping much verbal, problem solving, and mechanical ability "in reserve," to be applied only in the most demanding assessment situations.

4.1.2 Relationship between ASC scales/composites and other measures

In spite of the high correlations between the two composites and between some of the domain ASC scales, there were some significant differences in their relationships with academic outcomes. In nearly all of these cases, the maximal scale correlated more strongly than the typical scale with academic indicators, which was contrary to the hypotheses. However, these differences do indicate that, at least for some academic indicators and some ASC scales, the relationship is not the same for the typical and maximal scales. Not surprisingly, these differences occurred more often in domains with lower correlations between the scales. Whether these differences are stable and meaningful would need to be investigated in future research designed to address those questions.

Interestingly– and most importantly for the present study – typical and maximal ASC did differ in their relationship with Institute GPA, despite their high correlation with each other. I had proposed that the typical ASC composite would be significantly correlated with Institute GPA while the correlation between maximal ASC and Institute GPA would be negligible. The opposite was the case: maximal ASC was significantly correlated with Institute GPA, whereas the relationship between typical ASC and Institute GPA was essentially zero. The hypothesis was rooted in a view of college GPA as an indicator of sustained effort over time through assessment via cumulative exams, term papers, and the like, all of which require sustained effort for success (Ackerman & Kanfer, 2004). The belief was that in this type of situation, individual differences in ASC regarding one's "default" performance would be more important than ASC about one's peak performance. However, it is nonetheless the case that college grades are based largely on exams which, whether cumulative or not, certainly represent maximal environmental pressure. In addition, items in the maximal scales generally referenced classes, tests, and other graded projects. As a result, these items tapped the very behaviors that are relevant to the GPA, while the typical ASC items did not. It therefore is reasonable in hindsight that the maximal composite would be more strongly related to GPA. It remains surprising, however, that typical ASC is completely uncorrelated with GPA. Perhaps the typical items used in this study were drawn from a universe of potential items that was too broad. It is possible that a more successful measure of typical ASC would assess self-concept for situations that are school-related, but that are not related to exams and other graded efforts. For example, a better measure of typical ASC might ask respondents to rate their self-concept about their study habits or about

their understanding of course material presented in lectures, textbooks, or homework assignments, rather than querying participants about behaviors that are completely unrelated to schoolwork. In this alternative application of the typical/maximal framework, maximal items would specifically assess performance on exams, papers, and class projects.

Consistent with the internal/external frame of reference model described by Marsh (1986), verbal and math ASC were negatively correlated with each other. Interestingly, however, this was only true for maximal math ASC; correlations for both of the verbal ASC scales were correlated near-zero with typical math ASC. This may suggest that the apparent disconnect between verbal and math self-concepts is related to actual academic work in the two domains, rather than to everyday encounters with mathematical and verbal information. However, math and verbal abilities were positively correlated, as measured by the SAT, so the negligible correlations between the two verbal scales and typical math ASC are also inconsistent with ability measures. Additional research would be needed to investigate these relationships further. In any case, previous research by Marsh generally consisted of samples of high school students; the current findings demonstrate that the math/verbal discrepancy persists into the college years.

The exploratory correlational analysis of all ASC scales and all other measures in the study provides some insight into some salient correlates of ASC. Conscientiousness was significantly positively correlated with all ASC scales except for the verbal scales, and neuroticism was significantly negatively correlated with all ASC scales except for the verbal scales. This is somewhat in line with previous findings. Ackerman et al. (1995) reported a significant positive relationship between conscientiousness and math self-

concept, and significant negative correlations between neuroticism and both mechanical and spatial self-concept. Neither personality trait was significantly correlated with verbal self-concept. In the present study, a mastery-approach orientation was significantly correlated with all ASC scales and composites except for the two verbal ASC scales and the typical spatial ASC scale.

As discussed earlier, the maximal verbal ASC scale was not correlated with Institute GPA, unlike all the other maximal ASC scales and the maximal ASC composite. This finding, together with the results of the exploratory results discussed in the previous paragraph, suggests that verbal ASC may develop according to a different process than ASC in other domains. Although it does correlate with some measures (typical intellectual engagement, openness, and artistic and social vocational interests), it correlates near-zero with several other indicators that seem to have non-ignorable relationships with ASC in other domains. Faced with similarly puzzling results regarding verbal self-concept, Ackerman and Wolman (2007) suggested that other factors, such as grades (not measured in their study), may play a more important role in the development of verbal self-concept. Results from the present study do not appear to support this speculation. However, grade data was obtained as an aggregate indicator (i.e., as Institute GPA), and could not be analyzed by specific course content. It may be that verbal self-concept is influenced by performance specifically in English and other language courses, and that this relationship was not detectable under the weight of the math and science influence in the Institute GPA. On the other hand, Ackerman and Wolman (1997) found that verbal self-concept, unlike math and spatial self-concept, did not become more

accurate after participants received specific feedback about their performance on objective tests of verbal ability, so grades, as feedback, may not influence ASC.

Exploratory analyses also revealed that, in general, extrinsic motivation was negatively correlated with the typical ASC scales, and negligibly correlated with the maximal ASC scales. However, the overall moderate correlations between intrinsic motivation and all the ASC scales make this observation difficult to interpret. It may be that people who are less extrinsically motivated are more likely to engage in a variety of activities in their spare time and develop a positive self-concept about their performance in those activities. It may also be the case that people who are more motivated by extrinsic rewards are less likely to develop positive self-concepts about their performance in everyday tasks, because they to do not receive formal feedback from others regarding their performance on those tasks.

Identification with academics was positively correlated with the maximal ASC scales, and negligibly correlated with the typical ASC scales. This relationship may be due to increased effort allotted to academic endeavors by people who base their self-worth on how well they perform as students. Alternatively, the relationship may work in the opposite direction, such that people who have higher academic self-concept are more likely to identify strongly as students, and come to view their academic success as a major source of their self-worth. Of course, actual academic success may serve as a third variable in this relationship – identification with academics was correlated $r = .57$ with Institute GPA.

4.2 Gender Differences

The observed gender differences in ASC favoring men in domains other than verbal is consistent with the existing literature (Marsh, 1994; Marsh et al., 2005; Sullivan, 2009). An interesting finding in the present study is the fact that the effect sizes for the gender differences in SAT math and writing scores were similar to the effect sizes for the gender differences in maximal math and verbal ASC, respectively. This runs counter to reports from Marsh et al. (1988) that gender differences in ability did not fully account for gender differences in ASC, and to the suggestion by Furnham, Hosoe, et al. (2001) that men tend to overestimate their abilities while women tend to underestimate. An additional result that was interesting, especially in light of the mean gender differences, is that across genders, the correlations between ASC scores and academic indicators were mostly similar. The only exceptions were that maximal academic ASC was more strongly correlated with SAT verbal and writing scores for women than for men, and that typical verbal ASC scores were more strongly correlated with SAT verbal scores for men than for women, and more strongly (negatively) correlated with SAT math for women than for men. These findings may be anomalous, especially given their exploratory nature and the number of comparisons made in that particular analysis. However, a tentative interpretation is that men place less emphasis on their verbal abilities when they are assessing their general academic self-concept, that men rely more on objective feedback about their verbal abilities in developing their verbal self-concepts, and that women tend to make stronger intrapersonal comparisons between their own math and verbal abilities, yielding a stronger negative correlation between typical verbal ASC and SAT math score for women. The present analysis was necessarily limited by the fact that

objective measures were available only for math and verbal abilities. Additional research will be required to explore these relationships further.

4.3 Summary

Many of the results ran contrary to expectation, but interesting and potentially informative results were observed at the domain level and across genders. Given the typical/maximal distinction observed in some, but not all, of the domains, it is possible that a better typical ASC measure could be constructed that would be more predictive of college GPA. In addition, gender differences observed in both ASC and in the academic indicators suggest that gender differences in ASC are not due entirely to sex stereotypes or to overclaiming in men and underclaiming in women. These results could indicate avenues of future research in this area.

4.4 Theoretical Implications

Theoretical implications of these data are difficult to assess given the high correlations between the typical and maximal ASC composite and between some of the typical/maximal domain scale pairs. These results may indicate that the typical/maximal framework does not increase ASC's power to predict college GPA, and/or that typical and maximal ASC are not differentiable in some domains. Alternatively, the results may indicate that the framework has not been optimally applied in this particular instance. As mentioned above, future efforts would be required to test whether scales could be constructed that would yield lower typical/maximal correlations for the verbal, mechanical, and problem solving domains and for the composites, thus potentially increasing the predictive power of typical ASC.

4.5 Practical Implications

Given the near-zero correlation between typical ASC and GPA, practical implications of the present research are limited. It had been hoped that the new measure would serve as a meaningful predictor of college grades so that it could be used to identify students at risk of academic failure. In this regard, results are disappointing. However, the regression analysis did indicate that the current ASC measure accounted for variance in Institute GPA above and beyond the variance accounted for by SAT scores and high school GPA. This lends further support to previous findings that ASC is a unique predictor of grades (Kornilova et al., 2009; Marsh et al., 2005; Marsh & Yeung, 1997).

One possibility, not tested in this study, is that even though the typical ASC composite and some of the typical scales were not successful as predictors of Institute GPA, application of the typical/maximal framework helped to increase the validity of the maximal scales by restricting the range of situations that participants were asked to consider when responding to the items. This would need to be assessed in a separate study that would compare the present maximal ASC scales to existing ASC measures that do not make the maximal/typical distinction. This would be somewhat problematic since many of the items used in the present measure were derived from items in existing scales, which would artificially raise the correlation between the two, but it may be worthwhile to investigate whether the maximal ASC composite itself represents an improvement over existing measures, regardless of the success of the typical composite.

4.6 Limitations

The first and most obvious limitation of this study is that all participants were drawn from the Georgia Tech participant pool. As a highly selective, math-and-science-focused school, Georgia Tech may differ substantially from other colleges in terms of its student body, and results obtained here may not generalize to the general American college student population.

The second major limitation to the study is that both the ASC data and the GPA data were collected at the same point in time. As a result, the predictive validity of the composites for later outcomes such as grades and attrition could not be assessed. However, at this early stage of exploring the relationship between typical and maximal ASC, it was most reasonable to investigate correlations between assessments taken at the same time point in order to determine whether a more complex and resource-intensive longitudinal study is warranted.

4.7 Conclusion

This study represents an initial attempt to apply the typical/maximal framework to ASC. Most hypotheses regarding the relationships between typical and maximal ASC and other constructs and indicators were not supported, indicating a problem with the measure, the concept, or both. However, observed gender differences in both ASC and in the academic indicators suggest future directions for research. In addition, interesting relationships between the scales themselves were observed, suggesting that improvement may be possible. It may be that the universe of potential typical and maximal items was too broadly defined for this measure. A more narrowly defined typical ASC, one which

is explicitly tied to school situations other than major assessments such as exams, may be a more successful predictor of college performance.

APPENDIX

Item List for the Typical and Maximal ASC scales.

Items are rated on a scale of 1 (strongly disagree) to 6 (strongly agree). An asterisk indicates reverse scoring.

Academic/General Learning (maximal):

1. I have had trouble with most of the courses I have taken.*
2. I am good at most academic subjects.
3. I learn quickly in most of my classes.
4. I get good grades in most academic subjects.
5. I do not enjoy learning for my classes.*
6. Overall, I am a good student.
7. I often connect what I have learned in one class to my work in another.
8. I do well in my classes, even though I do not study very much.
9. Work in most school subjects is easy for me.
10. I struggle with most school subjects.*
11. I have done well in most school subjects.
12. I have a lot of intellectual curiosity when I am learning things for my classes.

Math (maximal):

1. I have always done well in math classes.
2. I never do well on tests that require mathematical reasoning.*
3. At school, my friends always come to me for help in math.

4. When I really try, I can usually find the correct solution to math problems presented in class or for homework.

5. No matter how hard I try, I simply do not do well in courses that involve a lot of math.*

6. In math classes, I can usually follow and understand the instructor's in-class examples.

7. College entrance exams (SAT, ACT) would be so much easier if there were no math section.*

8. I often have no idea how to do my math homework, even when we just covered the topic in class.*

9. I do not have to study very hard for math, compared with other subjects, in order to do well.

10. I get good grades in math classes.

11. Work in math classes is easy for me.

12. I learn things quickly in math classes.

13. Compared with others at Georgia Tech, I am good at classes that involve math.

14. I really struggle in math classes.*

15. Math is one of my best subjects.

Mechanical (maximal):

1. I have always done well in classes that involve mechanical reasoning.

2. I never do well on tests that require mechanical reasoning.*

3. When I really try, I can usually find the correct solution to problems that involve mechanical reasoning presented in class or for homework.

4. No matter how hard I try, I just do not do well in courses that require mechanical abilities.*

5. I often get confused when looking at diagrams or blueprints for classes.*

6. Compared with other subjects, I do not have to study very hard in order to do well in classes that require mechanical reasoning.

7. I get good grades in classes that involve mechanical ability.

8. Work in classes that involve mechanical abilities is easy for me.

9. I learn things quickly in classes that require mechanical reasoning.

10. Compared with other students at Georgia Tech, I am good at classes that involve mechanical abilities.

11. I am clueless when it comes to classes that place strong demands on mechanical abilities.*

12. I have always done well in classes that involve mechanical reasoning.

13. Classes that involve mechanical reasoning are my best subjects.

14. I do well on projects that let me use my mechanical abilities

Problem Solving (maximal):

1. I would have a really hard time with an assignment that involved thinking up an answer to a problem that has not already been solved.*

2. When I am writing a paper or doing a project, I am good at combining ideas in ways that others have not yet tried.

3. When I am working on assignments for school, I often wish I had more imagination and originality.*

4. I am not very good at problem solving when it comes to class assignments.*

5. I am not very original in my ideas, thoughts, and actions, even when I really need to be.*

6. I can be imaginative when I need to be (for example, when writing a story for class).

7. When I need to, I can often figure out better ways to do routine tasks.

8. I get good grades in classes that involve lots of problem solving.

9. Work in classes that involve problem solving is easy for me.

10. Compared with other students at Georgia Tech, I am good at classes that involve problem solving.

11. I really struggle in classes that involve lots of problem solving.*

12. I quickly learn things in classes that involve lots of problem solving.

13. I have always done well in classes that require problem solving.

Spatial (maximal):

1. I have always done well in classes that require spatial abilities.

2. I usually do not perform well on tests that require spatial reasoning.*

3. When I really try, I can usually find the correct solution to problems that involve spatial reasoning presented in class or for homework.

4. No matter how hard I try, I just do not do well in courses that require spatial abilities.*

5. Compared with other subjects, I do not have to study very hard in order to do well in classes that place strong demands on my spatial abilities.

6. I get good grades in classes that involve a lot of spatial ability.

7. Work in classes that involve spatial abilities is easy for me.

8. I learn things quickly in classes that require spatial abilities.

9. Compared with other students at Georgia Tech, I am good at classes that involve spatial abilities.

10. I am hopeless when it comes to classes that place heavy demands on spatial abilities.*

11. Classes that let me use my spatial abilities are my best subjects.

13. I do well on projects that let me use my spatial abilities

Verbal (maximal):

1. I have trouble expressing myself when trying to write a paper for class.*

2. I can write effectively when I am writing an assignment for one of my classes.

3. When I am writing papers or talking to professors, my vocabulary is not as good as I would like it to be.*

4. I do not do well on tests that require verbal reasoning ability.*

5. Relative to most other students, the papers that I write are quite good.

6. Relative to most other students, my oral presentations in class are quite good.

7. When I really need to express myself in words, I can.

8. When I am reading something that was assigned for a class, I have good reading comprehension.

9. College entrance exams (SAT, ACT) would be much easier if there were no verbal section.*

10. Compared with other subjects, I do not have to study very hard for my English classes in order to do well.

11. I get good grades in English classes.

12. Work in English classes is easy for me.

13. Compared with other students at Georgia Tech, I am good at classes that involve English language skills.

14. I really struggle when doing work for English classes.*

15. I learn things quickly in English classes.

16. I have always done well in English classes.

17. English is one of my best subjects.

Academic/General Learning (typical):

1. I find it hard to learn new things in everyday life.*

2. I am good at learning new skills and information in everyday life.

3. I usually learn new skills and information quickly in everyday life.

4. People compliment me on my general knowledge.

5. I tend to notice things that others overlook.

6. I like watching quiz shows like *Jeopardy*.

7. I like playing trivia games like Trivial Pursuit.

8. When people talk about current events in the U.S. or the world, I usually do not know what they are talking about.*

9. I am reluctant to learn about topics I do not already know about.*

10. I like to watch documentaries.

11. I like telling other people about the things I have learned.

12. Before traveling to a new city or country, I like to learn about its culture and history.

13. I do not like hanging out with people who have a lot of intellectual conversations.*

14. I will put more effort into finding information about something I need for a class than something that I am just curious about.*

15. I am curious about many things that I am not learning about in school.

Math (typical):

1. I use math effectively in everyday life.

2. When something needs to be calculated in everyday life (for example, a tip at a restaurant), my friends always turn to me.

3. When I am reading the news, I skip articles that involve a lot of math (for example, financial articles).*

4. Managing my personal finances is intimidating because of all the math involved.*

5. I like doing puzzles that involve numbers.

6. I do more everyday math problems (eg. calculating a tip) in my head than my friends do.

7. I am glad that my cell phone has a calculator, so that I do not have to calculate things in my head.*

8. When I am buying several items at the store, I do not really have a sense of how much the bill will be until I check out*

9. I like to keep track of where my money is going.

10. When I am running/biking/driving, I often mentally calculate things like my pace, how much longer until I finish, etc.

11. When someone else does math, I take their word for it rather than checking it myself.*

12. When an item is on sale for a percentage off the original price, I calculate how much the sale price is before deciding whether to buy it.

Mechanical (typical):

1. I like to look at diagrams that show how things work.

2. I have a really hard time following the directions to assemble something.*

3. If I have done a repair (bicycle, home, car) once, I can do it again without looking up instructions.

4. I like to take things apart to see how they work.

5. I often do my own simple repairs (bicycle, home, car).

6. When something mechanical breaks, I try to figure out what is wrong with it.

7. I like to build things.

8. I like to learn about how things work mechanically.

9. I do not know how to use most of the tools in a typical toolbox.*

10. I can read measurement equipment that I come across in everyday life (thermometers, rulers, gauges, etc.).

11. If a mechanic tried to explain to me what was wrong with a car, I would have no idea what he or she was talking about.*

12. When something falls apart, I can figure out how to put it back together so that it works.

Problem Solving (typical):

1. I am never able to think up answers to everyday problems that have not already been figured out.*

2. When I am hanging out with my friends, I often come up with ways to combine ideas in ways that others have not yet tried.

3. When I am interacting with my friends, I often wish I had more imagination and/or originality.*

4. I am not very good at problem solving in everyday life.*

5. In everyday life, I am not very original in my ideas, thoughts, and actions.*

6. I am a generally imaginative person.

7. I can often find better ways of doing routine tasks, even when no one has asked me to.

8. My favorite kinds of board/computer/video games are those that involve a lot of strategy.

9. When I need to complete a complicated task or project, I develop a plan before I start.

10. When a computer program (like Word or Excel) does something I do not want it to do, I can usually figure out how to fix it.

11. I often take on challenges, just for the fun of figuring out solutions.

12. I like doing logic problems and puzzles.

Spatial (typical):

1. I just cannot give good directions, even when I know an area well.*

2. When I need to make a detour (for example, due to traffic or construction), I can easily find my way back to my original route.

3. When I have a list of errands to run or places to go, I can plan out the most efficient route without much effort.

4. I have a hard time making sense of maps.*

5. When rearranging furniture, I can easily visualize the options without physically moving the furniture.

6. I am usually correct when I think that something (for example, a desk or other furniture) will or will not fit in a given space.

7. If I was in an unfamiliar city with only a map, I could find my way around.

8. I am good a jigsaw puzzles.

9. Once I have been to a place once, I can always remember how to get there.

10. I am good at retracing my route to get back to my starting point, even in an unfamiliar place.

11. When giving directions, I can easily visualize the route in my mind.

12. Even when someone gives me directions, I often get lost.*

13. I am good at Tetris.

Verbal (typical):

1. I have trouble expressing myself when I am trying to write an email to a friend.*

2. I can write effectively when I am writing a note to a friend.

3. In everyday conversations, I do not use many big or uncommon words.*

4. I am an avid reader

5. Relative to most other people, my skills for everyday writing (for example, emails, notes, letters) are quite good.

6. Relative to most other people, my skills for everyday speaking (for example, talking with friends) are quite good.

7. Generally, I am good at expressing myself.

8. I have good reading comprehension when I am reading magazines, books, or news articles in my spare time.

9. When I am reading a news article, I always notice typos and grammatical mistakes.

10. I like to play games that involve words (for example, Scrabble, Bananagrams, Boggle).

11. When someone makes a play on words, I am usually the last to get it.*

12. I like comedy that involves lots of verbal humor.

13. When I'm typing a casual email, I do not use proper punctuation/capitalization.*

REFERENCES

Ackerman, P.L., & Goff, M. (1994). Typical intellectual engagement and personality: Reply to Rocklin. *Journal of Educational Psychology, 86*, 150-153.

Ackerman, P.L., & Heggestad, E.D. (1997). Intelligence, personality, and interests: Evidence for overlapping traits. *Psychological Bulletin, 121*, 219-245.

Ackerman, P.L., & Kanfer, R. (2004). Cognitive, affective, and conative aspects of adult intellect within a typical and maximal performance framework. In: Dai, D.Y., & Sternberg, R.J. (Eds.). *Motivation, emotion, and cognition: Integrative perspectives on intellectual functioning and development*. Mahwah, NJ: Lawrence Erlbaum Associates.

Ackerman, P.L., & Kanfer, R., Goff, M. (1995). Cognitive and noncognitive determinants and consequences of complex skill acquisition. *Journal of Experimental Psychology: Applied, 1*, 270-304.

Ackerman, P.L., & Wolman, S.D. (2007). Determinants and validity of self-estimates of abilities and self-concept measures. *Journal of Experimental Psychology: Applied, 13*, 57-78.

Amabile, T.M., Hill, K.G., Hennessey, B.A., & Tighe, E.M. (1994). The Work Preference Inventory: Assessing intrinsic and extrinsic motivational orientations. *Journal of Personality and Social Psychology, 66*, 950-967.

Arens, A.K., Yeung, A S., Craven, R.G., & Hasselhorn, M. (2011). The twofold multidimensionality of academic self-concept: Domain specificity and separation between competence and affect components. *Journal of Educational Psychology, 103*, 970-981.

Bandura, A. (1977). *Social learning theory.* Englewood Cliffs, NJ: Prentice-Hall.

Bandura, A. (1997). *Self-efficacy: The exercise of control.* New York, NY: Freeman.

Bong, M., & Clark, R.E. (1999). Comparison between self-concept and self-efficacy in academic motivation research. *Educational Psychologist, 34*, 139-153.

Bong, M., & Skaalvik, E.M. (2003). Academic self-concept and self-efficacy: How different are they really? *Educational Psychology Review, 15*, 1-40.

Byrne, B.M. (1996). *Measuring self-concept across the lifespan: Issues and instrumentation.* Washington, DC: American Psychological Association.

Calsyn, R., & Kenny, D. (1977). Self-concept of ability and perceived evaluations by others: Cause or effect of academic achievement? *Journal of Educational Psychology, 69*, 136-145.

Chamorro-Premuzic, T., Furnham, A., & Ackerman, P.L. (2006). Incremental validity of the typical intellectual engagement scale as a predictor of different academic performance measures. *Journal of Personality Assessment, 87*, 261-268.

Choi, N. (2005). Self-efficacy and self-concept as predictors of college students' academic performance. *Psychology in the Schools, 42*, 197-205.

Chouinard, R., Karsenti, T., & Roy, N. (2007). Relations among competence beliefs, utility value, achievement goals, and effort in mathematics. *British Journal of Educational Psychology*, *77*, 501-517.

Cohen, J., Cohen, P., West, S.G., & Aiken, L.S. (2003). *Applied multiple regression/correlation analysis for the behavioral sciences* (3rd ed.). New York, NY: Lawrence Erlbaum Associates.

Costa, P.T., & McCrae, R.R. (1992). *Revised NEO Personality Inventory (NEO PI-R) and NEO Five-Factor Inventory (NEO-FFI): Professional manual.* Odessa, FL: Psychological Assessment Resources.

Cronbach, L.J. (1970). *Essentials of psychological testing* (3rd ed.). New York, NY: Harper & Row.

Darcy, M., & Tracey, T.J.G. (2003). Integrating abilities and interests in career choice: Maximal versus typical assessment. *Journal of Career Assessment, 11*, 219-237.

Deadrick, D.L., & Gardner, D.G. (2008). Maximal and typical measures of job performance: An analysis of performance variability over time. *Human Resources Management Review, 18*, 133-145.

Denissen, J.J., Zarrett, N.R., & Eccles, J.S. (2007). I like to do it, I'm able, and I know I am: Longitudinal couplings between domain-specific achievement, self-concept, and interest. *Child Development*, *78*, 430-447.

Dweck, C.S. (1999). *Self-theories: Their role in motivation, personality, and development*. Ann Arbor, MI: Edwards Brothers.

Dweck, C.S., Chiu, C.-Y., & Hong, Y.-Y. (1995) Implicit theories and their role in judgments and reactions: A world from two perspectives. *Psychological Inquiry, 6*, 267-285.

Elliot, A.J., & McGregor, H.A. (2001). A 2 x 2 achievement goal framework. *Journal of Personality and Social Psychology, 80*, 501-519.

Furnham, A. (1984). The Protestant work ethic: A review of the psychological literature. *European Journal of Social Psychology, 14,* 87-104.

Furnham, A., Hosoe, T., & Tang, T.L. (2001). Male hubris and female humility? A cross-cultural study of ratings of self, parental, and sibling multiple intelligence in America, Britain, and Japan. *Intelligence, 30,* 101-115.

Furnham, A., & Koritsas, E. (1990). The Protestant work ethic and vocational preference. *Journal of Organizational Behavior, 11,* 43-55.

Furnham, A., Masters, J., Bond, M., Payne, M., Heaven, P., Rajamanikam, R., Hilton, D., Stacey, B., Lobel, T., & van Daalen, H. (2001). A comparison of Protestant work ethic beliefs in thirteen nations. *The Journal of Social Psychology, 133,* 185-197.

Goff, M. (1994). *Understanding vocational self-concept and related domains: A hierarchical factor-analytic approach.* (Unpublished doctoral dissertation). University of Minnesota, Minneapolis, MN.

Goff, M., & Ackerman, P.L. (1992). Personality-intelligence relations: Assessment of typical intellectual engagement. *Journal of Educational Psychology, 84,* 537-552.

Guay, F., Marsh, H.W., & Boivin, M. (2003). Academic self-concept and academic achievement: Developmental perspectives and their causal ordering. *Journal of Educational Psychology, 95,* 124-136.

Harackiewicz, J.M., Barron, K.E., Tauer, J.M., & Carter, S.M. (2000). Short-term and long-term consequences of achievement goals: Predicting interest and performance over time. *Journal of Educational Psychology, 92,* 316-330.

Haugen, R., Ommundsen, Y., & Lund, T. (2004). The concept of expectancy: A central factor in various personality dispositions. *Educational Psychology, 24,* 43-55.

House, J.D. (1993). The relationship between academic self-concept and school withdrawal. *The Journal of Social Psychology, 133,* 125-127.

Howell, A.J., & Buro, K. (2009). Implicit beliefs, achievement goals, and procrastination: A meditational analysis. *Learning and Individual Differences, 19,* 151-154.

Hsieh, P., Sullivan, J.R., & Guerra, N.S. (2007). A closer look at college students: Self-efficacy and goal orientation. *Journal of Advanced Academics, 18,* 454-476.

James, W. (1890/1981). *The principles of psychology*. Harvard University Press: Cambridge, MA.

John, O.P., & Srivastava, S. (1999). The Big Five trait taxonomy: History, measurement, and theoretical perspectives. In: L.A. Pervin & O.P. John (Eds.), *Handbook of personality: Theory and research* (2nd ed.) (pp. 102-138). New York: The Guilford Press.

Kanfer, R., Ackerman, P.L., & Heggestad, E.D. (1996). Motivational skills and self-regulation for learning: A trait perspective. *Learning and Individual Differences, 8*, 185-209.

Kobrin, J.L., Patterson, B.F., Shaw, E.J., Mattern, K.D., & Barbuti, S.M. (2008). *Validity of the SAT for predicting first-year college grade point average.* (Report No. 2008-5). New York, NY: The College Board.

Kornilova, T.V., Kornilov, S.A., & Chumakova, M.A. (2009). Subjective evaluations of intelligence and academic self-concept predict academic achievement: Evidence from a selective student population. *Learning and Individual Differences, 19*, 596-608.

Lamb, R.R., & Prediger, D.J. (1981). *Technical report for the unisex edition of the ACT Interest Inventory (UNIACT)*. Iowa City, IA: American College Testing Program.

Lent, R.W., Brown, S.D., Gore, P.A., Jr. (1997). Discriminant and predictive validity of academic self-concept, academic self-efficacy, and mathematics-specific self-efficacy. *Journal of Counseling Psychology, 44*, 307-315.

Marčič, R., & Kobal Grum, D. (2011). Gender differences in self-concept and self-esteem components. *Studia Psychologica, 53*, 373-384.

Marsh, H.W. (1986). Verbal and math self-concepts: An internal/external frame of reference model. *American Educational Research Journal, 23*, 129-149.

Marsh, H.W. (1987). The big-fish-little-pond effect on academic self-concept. *Journal of Educational Psychology, 79*, 280-295.

Marsh, H.W. (1994). Using the National Longitudinal Study of 1988 to evaluate theoretical models of self-concept: The Self-Description Questionnaire. *Journal of Educational Psychology, 86*, 439-456.

Marsh, H.W. (1990a). Causal ordering of academic self-concept and academic achievement: A multiwave, longitudinal panel analysis. *Journal of Educational Psychology, 82*, 646-656.

Marsh, H.W. (1990b). The structure of academic self-concept: The Marsh/Shavelson model. *Journal of Educational Psychology, 82*, 623-636.

Marsh, H.W., Byrne, B.M., & Shavelson, R.J. (1988). A multifaceted academic self-concept: Its hierarchical structure and its relation to academic achievement. *Journal of Educational Psychology, 80,* 366-380.

Marsh, H.W., & Craven, R.G. (2006). Reciprocal effects of self-concept and performance from a multidimensional perspective: Beyond seductive pleasure and unidimensional perspectives. *Perspectives on Psychological Science, 1*, 133-163.

Marsh, H.W., & O'Neill, R. (1984). Self Description Questionnaire III: The construct validity of multidimensional self-concept ratings by late adolescents. *Journal of Educational Measurement, 21*, 153-174.

Marsh, H.W., & Shavelson, R. (1985). Self-concept: Its multifaceted, hierarchical structure. *Educational Psychologist, 20,* 107-123.

Marsh, H.W., Trautwein, U., Lüdtke, O., Köller, O. (2008). Social comparison and big-fish-little-pond effects on self-concept and other self-belief constructs: Role of generalized and specific others. *Journal of Educational Psychology, 100,* 510-524.

Marsh, H.W., Trautwein, U., Lüdtke, O., Köller, O., & Baumert, J. (2005). Academic self-concept, interest, grades, and standardized test scores: Reciprocal effects models of causal ordering. *Child Development, 76,* 397-416.

Marsh, H.W., Trautwein, U., Lüdtke, O., Köller, O., & Baumert, J. (2006). Integration of multidimensional self-concept and core personality constructs: Construct validation sand relations to well-being and achievement. *Journal of Personality, 74,* 403-456.

Marsh, H.W., Walker, R., & Debus, R. (1991). Subject-specific components of academic self-concept and self-efficacy. *Contemporary Educational Psychology, 16,* 331-345.

Marsh, H.W. & Yeung, A.S. (1997). Causal effects of academic self-concept on academic achievement: Structural equation models of longitudinal data. *Journal of Educational Psychology, 89,* 41-54.

Mirels, H.L., & Garrett, J.B. (1971). The Protestant ethic as a personality variable. *Journal of Consulting and Clinical Psychology, 36,* 40-44.

Mischel, W. (1977). On the future of personality measurement. *American Psychologist, 32,* 246-254.

Mullis, A.K., Mullis, R.L., & Brailsford, J.C. (1997). Relationships between academic comfort and career interests among rural high school students. *Psychological Reports, 80,* 459-466.

Norem, J.K., & Cantor, N. (1986). Defensive pessimism: Harnessing anxiety as motivation. *Journal of Personality and Social Psychology, 51*, 1208-1217.

Norem, J.K., & Illingworth, K.S.S. (1993). Strategy-dependent effects of reflecting on self and tasks: Some implications of optimism and defensive pessimism. *Journal of Personality and Social Psychology, 65*, 822-835.

Osborne, J.W. (1997). Identification with academic and academic success among community college students. *Community College Review, 25*, 59-67.

Osborne, J.W., & Jones, B.D. (2011). Identification with academics and motivation to achieve in school: How the structure of the self influences academic outcomes. *Educational Psychology Review, 23*, 131-158.

Pajares, F., & Miller, M.D. (1995). Mathematics self-efficacy and mathematics performances: The need for specificity of assessment. *Journal of Counseling Psychology, 42*, 190-198.

Peterson, E.R., & Whiteman, M.C. (2007). "I think I can, I think I can…": The interrelationships among self-assessed intelligence, self-concept, self-efficacy and the personality trait intellect in university students in Scotland and New Zealand. *Personality and Individual Differences, 43*, 959-968.

Pinxten, M., De Fraine, B., Van Damme, J., & D'Haenens, E. (2010). Causal ordering of academic self-concept and achievement: Effects of type of achievement measure. *British Journal of Educational Psychology, 80*, 689-709.

Prediger, D.J. (1982). Dimensions underlying Holland's hexagon: Missing link between interests and occupations? *Journal of Vocational Behavior, 21*, 259-287.

Pulford, B.D., & Sohal, H. (2006). The influence of personality on HE students' confidence in their academic abilities. *Personality and Individual Differences, 41*, 1409-1419.

Rinn, A.N. (2005). Trends among honors college students: An analysis by year in school. *The Journal of Secondary Gifted Education, 16*, 157-167.

Rinn, A.N., & Cunningham, L.G. (2008). Using self-concept instruments with high-ability college students. *Gifted Child Quarterly, 52*, 232-242.

Robins, R. W., & Pals, J.L. (2002). Implicit self-theories in the academic domain: Implications for goal orientation, attributions, affect, and self-esteem change. *Self and Identity, 1*, 313-336.

Rosenberg, M. (1965). *Society and the Adolescent Self-Image*. Princeton, NJ: Princeton University Press.

Shavelson, R.J., Hubner, J.J., & Stanton, G.C. (1976). Self-concept: Validation of construct interpretations. *Review of Educational Research, 46*, 407-441.

Skaalvik, E.M. (1997) Self-enhancing and self-defeating ego orientation: Relations with task avoidance orientation, achievement, self-perceptions, and anxiety. *Journal of Educational Psychology, 89*, 71-81.

Steiger, J.H. (1980). Tests for comparing elements of a correlation matrix. *Psychological Bulletin, 87*, 245-251.

Sullivan, A. (2009). Academic self-concept, gender, and single-sex schooling. *British Education Research Journal, 35*, 259-288.

Trautwein, U., Lüdtke, O., Köller, O., & Baumert, J. (2006). Self-esteem, academic self-concept, and achievement: How the learning environment moderates the dynamics of self-concept. *Journal of Personality and Social Psychology, 90*, 334-349.

Turner, R.G. (1978). Consistency, self-consciousness, and the predictive validity of typical and maximal personality measures. *Journal of Research in Personality, 12*, 117-132.

Valentine, J.C., DuBois, D.L., & Cooper, H. (2004). The relation between self-beliefs and academic achievement: A meta-analytic review. *Educational Psychologist, 39*, 111-133.

Viswanathan, M. (1993). Measurement of individual differences in preference for numerical information. *Journal of Applied Psychology, 78*, 741-752.

Walker, C.O., Greene, B.A., & Mansell, R.A. (2006) Identification with academics, intrinsic/extrinsic motivation, and self-efficacy as predictors of cognitive engagement. *Learning and Individual Differences, 16*, 1-12.

Wallace, J. (1966). An abilities conception of personality: Some implications for personality measurement. *American Psychologist, 21*, 132-138.

Willerman, L., Turner, R.G., & Peterson, M. (1976). A comparison of the predictive validity of typical and maximal personality measures. *Journal of Research in Personality, 10*, 482-492.

Wittmann, W.W., & Suß, H.-M. (1999). Investigating the paths between working memory, intelligence, knowledge, and complex problem-solving performances via Brunswik Symmetry. In P.L. Ackerman, P.C. Kyllonen, & R.D. Roberts (Eds.), *Learning and Individual Differences: Process, Trait, and Content Determinants* (pp. 77-104). Washington, DC: American Psychological Association.