

Study Habits, Skills, and Attitudes

The Third Pillar Supporting Collegiate Academic Performance

Marcus Credé¹ and Nathan R. Kuncel²

¹University at Albany, SUNY, and ²University of Minnesota

ABSTRACT—*Study habit, skill, and attitude inventories and constructs were found to rival standardized tests and previous grades as predictors of academic performance, yielding substantial incremental validity in predicting academic performance. This meta-analysis (N = 72,431, k = 344) examines the construct validity and predictive validity of 10 study skill constructs for college students. We found that study skill inventories and constructs are largely independent of both high school grades and scores on standardized admissions tests but moderately related to various personality constructs; these results are inconsistent with previous theories. Study motivation and study skills exhibit the strongest relationships with both grade point average and grades in individual classes. Academic specific anxiety was found to be an important negative predictor of performance. In addition, significant variation in the validity of specific inventories is shown. Scores on traditional study habit and attitude inventories are the most predictive of performance, whereas scores on inventories based on the popular depth-of-processing perspective are shown to be least predictive of the examined criteria. Overall, study habit and skill measures improve prediction of academic performance more than any other noncognitive individual difference variable examined to date and should be regarded as the third pillar of academic success.*

Our investment in higher education is enormous. We are painfully reminded of this whenever seemingly qualified students fail in college or drop out from graduate school. What explains

these performance discrepancies? To protect this investment, researchers have focused on understanding the academic success and failure of students and have examined a wide array of student characteristics as determinants of academic performance. These individual difference factors can be coarsely subdivided into intellectual (cognitive) and nonintellectual (noncognitive) factors. Psychology and education have a good grasp on the intellectual factors that encompass most of the variables typically considered in the admissions process, such as scores on cognitively loaded admissions tests. Recent meta-analytic evidence has shown that a consideration of these intellectual factors is valuable given the substantial predictive validities of students' prior grades and the ubiquitous predictive power of admissions tests at both the college and graduate school levels across a range of outcome variables (e.g., Bridgeman, McCamley-Jenkins, & Ervin, 2000; Halpin, Halpin, & Schaar, 1981; Kuncel, Credé, & Thomas, 2007; Kuncel & Hezlett, 2007; Kuncel, Hezlett, & Ones, 2001, 2004; Noble, 1991). Despite the impressive predictive validities of intellectual factors with regard to academic achievement, researchers have turned their attention to nonintellectual factors for two broad reasons.

First, all stakeholders are interested in making better admissions decisions. Students, faculty, universities, and society have a vested interest in successful students. This has led to an ongoing search for additional variables that may improve the quality of admissions decisions and improve our understanding of academic performance. Second, the reliance on intellectual factors has produced adverse impact in the admission process (Sackett, Schmitt, Ellingson, & Kabin, 2001), due to the substantial group differences that have been observed in scores on both cognitive admissions tests and prior grades (e.g., Zwick, 2004). A consideration of nonintellectual factors in the admissions process may have the applied benefit of reducing adverse impact while simultaneously increasing the accuracy of admissions decisions.

Address correspondence to Marcus Credé, Department of Psychology, University at Albany, SUNY, Social Sciences 369, 1400 Washington Avenue, Albany, NY 12222; e-mail: mcrede@albany.edu.

The evidence regarding the validity of scores on inventories of nonintellectual factors, however, has often been underwhelming. Observed relationships between personality and academic achievement have typically been low (e.g., Ridgell & Lounsbury, 2004; Thomas, Kuncel, & Credé, 2007; Zagar, Arbit, & Wengel, 1982). Not surprisingly, only specific aspects of temperament are relevant in academic situations, as is the case in work settings (e.g., conscientiousness, Duff, Boyle, Dunleavy, & Ferguson, 2004; Lievens, Coetsier, De Fruyt, & De Maeseneer, 2002), and these relationships are markedly smaller than those obtained from tests and prior grades. Recent work has shown more promising levels of validity for scores on biographical inventories and situational judgment tests (Oswald, Schmitt, Kim, Ramsay, & Gillespie, 2004), as well as for a variety of psycho-social variables including academic motivation, achievement motivation, and academic self-efficacy (Robbins et al., 2004). However, some of these factors are also likely to be associated with opportunity and social class, and some are not readily modifiable through intervention.

Another promising group of highly academically focused factors relate specifically to the studying and learning behaviors of students. The empirical and theoretical literature relating to these constructs is very large and very fragmented, described by a wide variety of proposed constructs, and operationalized by an array of inventories. Proposed constructs include study skills (e.g., Aaron & Skakun, 1999), study habits (e.g., Murray & Wren, 2003), study attitudes (e.g., W.S. Zimmerman, Parks, Gray, & Michael, 1977), study motivation (e.g., Melancon, 2002), meta-cognitive skills (e.g., Zeegers, 2001), study anxiety (e.g., Miller & Michael, 1972), and depth of processing (e.g., C.W. Hall, 2001). Frequently used inventories of these constructs are comparably numerous and include the Survey of Study Habits and Attitudes (SSHA; W.F. Brown & Holtzman, 1967), Learning and Study Skills Inventory (LASSI; Weinstein, & Palmer, 2002), Inventory of Learning Processes (Schmeck, Geisler-Brenstein, & Cercy, 1991), and the Study Process Questionnaire (Biggs, 1987).

However, “promising” does not mean “proven.” Assessment and training are not free, and study habits, skills, and attitudes (SHSAs) would need more than strong correlations with subsequent performance to be powerful predictors—they would also need to add considerable unique information to the existing measures to warrant their use. Despite the considerable research attention focused on these various constructs, these issues have not been resolved, and the precise nature of the constructs’ relationship to academic performance is not well understood. The combination of construct proliferation and mixed findings in the literature has led to this state. The development of a taxonomy combined with a meta-analytic review will likely provide clarity and condense the extensive but fragmented empirical literature and the variety of theoretical and empirical approaches. We anticipate both practical and theoretical benefits.

At a practical level, we anticipate benefits for the admissions process, college counseling programs, and for the measurement of SHSAs. We do not believe that self-reports of study behaviors as currently measured are likely to be particularly useful in an admissions context given the susceptibility of such inventories to faking and socially desirable responding.¹ Rather, we anticipate that ratings of SHSA constructs would be more useful when provided by high school counselors, principals, or teachers, particularly if these ratings are made using psychometrically sound rating forms.

In addition, capturing accurate SHSA information about college applicants in a low-stakes development context would allow admissions officers to better identify students who would be able to succeed in college and would allow college counselors to better anticipate the academic difficulties of at-risk students (e.g., students with sound admissions test scores but poor study habits). Meta-analytic results illustrating meaningful relationships between SHSA constructs and academic performance may act as a spur for the development and use of such rating forms. It is also important to note that a meta-analytic review will directly benefit training and counseling programs that focus on providing students with better SHSAs by highlighting constructs and processes that are most strongly related to performance in college. Programs that focus on the acquisition of specific study skills are likely to be particularly useful in light of the consistent finding that the amount of studying (time spent studying) is largely unrelated to academic performance (e.g., Mael, Morath, & McLellan, 1997; Schuman, Walsh, Olson, & Etheridge, 1985). Improving study-skill training interventions appears to be particularly important given meta-analytic evidence that the impact of study-skill training interventions on both reported study practices and performance is strongly moderated by the type of study skill training (Hattie, Biggs, & Purdie, 1996).

Identifying SHSA constructs that are most strongly related to academic performance should assist in both identifying ineffective training methods and in identifying what the focus of training programs should be. Those that are most strongly related to academic performance may, all else being equal, be of the highest utility as candidates for training. A final practical benefit is that a meta-analytic review will also likely establish whether or not scores on different inventories of SHSA constructs are differentially valid with regard to college performance. This would allow researchers and practitioners in the SHSA domain to make informed decisions regarding the appropriateness of different inventories and may also provide motivation for the refinement of existing inventories.

¹However, the current state of research on detection and control of faking on personality and related tests is as promising as it has ever been with the recent development of a variety of promising methods (Bagby et al., 1997; Eid & Zickar, 2007; Kuncel & Borneman, 2007). Proven versions of these methods may be operational soon. What will remain to be seen is if they can resist the inevitable flood of coaching methods that follow high-stakes testing.

A better understanding of how SHSA constructs relate to academic performance will also facilitate a better theoretical understanding of how various individual difference factors are related to academic performance. The predictive power of scores on cognitive instruments such as the SAT or GRE have a good deal of utility in the selection process, but these scores on their own do not provide us with a full understanding of why success or failure occurs (e.g., McCall, 1994; Romine & Crowell, 1981). SHSA constructs can provide us with a better understanding of these phenomena, especially if we consider that, by some accounts, many freshmen college students do not possess the repertoire of study skills and study habits necessary to effectively cope with the academic requirement of colleges (e.g., Bishop, Bauer, & Becker, 1998; Hechinger, 1982; Sanoff, 2006) or to prepare effectively for high stakes testing situations (e.g., Loken, Radlinks, Crespi, Millet, & Cushing, 2004).

Specifically, measures of cognitive ability provide an indication of whether a student has the ability to learn and understand complex material, but they do not indicate whether the student has acquired the patterns of studying behavior that are necessary to process, integrate, and recall such material. Different SHSA constructs can provide information about whether this is a matter of attitudes toward studying (e.g., “I feel that it is not worth the time, money, and effort that one must spend to get a college education”), actual study behaviors (e.g., “I stop periodically while reading and mentally go over or review what was said”), or the cognitive processes engaged in by students while studying (e.g., “I make connections among the different ideas or topics I am studying in my courses”). A better understanding of the potentially different relationships among SHSA constructs and academic performance can be attained by considering the dimensionality of SHSAs and how these constructs fit into existing theoretical frameworks of performance in general and of college performance in particular.

THEORIES AND MEASURES OF STUDY BEHAVIORS

The Dimensionality of SHSAs

The research literature on SHSAs dates back over 65 years (e.g., Hartson, Johnson, & Manson, 1942; L. Jones & Ruch, 1928; Locke, 1940), but substantial disagreement remains as to the dimensionality and structure of SHSAs. This lack of agreement appears to be largely a function of the differing ways in which operationalizations of SHSAs have been developed. Although some researchers have adopted a strictly empirical approach whereby items that optimally distinguish between over- and underachievers are factor analyzed to generate constructs (e.g., W.F. Brown & Holtzman, 1955), others have based inventories on theoretical considerations (e.g., Entwistle, Thompson, & Wilson, 1974) or on qualitative analyses of the verbalized strategies used by students when studying (e.g., Marton, Hounsell, & Entwistle, 1984; Pressley & Afflerbach, 1995). In all, scales and research in this domain tend to focus on one of

three broad areas: SHSAs themselves, the depth at which information is processed while studying, and the metacognitive awareness of the studying student.

Study Skills, Study Habits, and Study Attitudes

As typically used in the broader literature, study skills refers to the student’s knowledge of appropriate study strategies and methods and the ability to manage time and other resources to meet the demands of the academic tasks. Study habits typically denotes the degree to which the student engages in regular acts of studying that are characterized by appropriate studying routines (e.g., reviews of material) occurring in an environment that is conducive to studying. Finally, study attitudes is usually used to refer to a student’s positive attitude toward the specific act of studying and the student’s acceptance and approval of the broader goals of a college education.

Early inventories of SHSAs (e.g., Hartson et al., 1942; Locke, 1940; Michael & Reeder, 1952) were largely unidimensional in nature, but a finer delineation of the construct space has occurred over time. Many inventories have sought especially to distinguish between study skills, study habits, and study attitudes. The SSHA (Brown & Holtzman, 1955, 1956) and the LASSI (C.E. Weinstein & Palmer, 2002) are two examples of this distinction and are the most widely used inventories of SHSAs. Brown and Holtzman proposed a hierarchical structure for the SSHA comprised of four variables—delay avoidance, work methods, educational acceptance, and teacher approval—that are combined into two higher level scores of study habits (delay avoidance and work methods) and study attitudes (educational acceptance and teacher approval). These two are in turn, aggregated to obtain a general study orientation score. The LASSI assesses even more SHSA dimensions, being comprised of 10 subscales: anxiety, attitude, concentration, information processing, motivation, selecting main ideas, self-testing, study aids, test strategies, and time management. Each of the 10 subscales is, in turn, related to one of three strategic learning components that reflect the distinction between study skills, study attitudes, and study habits: *skill* (information processing, selecting main ideas, and test strategies), *will* (anxiety, attitude, and motivation), and *self-regulation* (concentration, self-testing, study aids, and time management).

Information Processing Approaches

Although inventories such as the SSHA and LASSI distinguish among specific study competencies as well as among habits, attitudes, and skills, other educational researchers have focused on the depth at which students process the information that is being studied. This approach is based on the information processing model of memory, which proposes that individuals remember material more accurately if the material is processed at a deep level rather than at a surface level (e.g., Craik & Lockhart, 1972; Marton & Säljö, 1976). Deep processing

involves relating new material to the existing knowledge structure, whereas a surface approach focuses primarily on rote memorization leading to a reproduction of new material without integration with existing information.

Biggs and colleagues and Entwistle and colleagues (e.g., Biggs, 1979; Biggs, Kember, & Leung, 2001; Entwistle, Hanley, & Hounsell, 1979; Entwistle & Ramsden, 1983; Entwistle & Waterson, 1988) expand on this information processing framework by including three processing approaches and associated motivational determinants: (a) the deep approach, which is driven by one's internal motivation and commitment to learning; (b) the surface approach, which is driven by one's external motivation; and (c) the strategic approach, which is driven by one's motivation to attain high grades without regard to learning of any type. This general theoretical framework and the associated desirability of a deep approach to studying has been widely acknowledged in the literature (e.g., Diseth & Martinsen, 2003; Entwistle & Waterson, 1988; Marton, 1976; Schmeck & Grove, 1979; Schmeck, Ribich, & Ramanaiah, 1977; Schmeck & Spofford, 1982; Watkins, 1983).

Metacognitive Skill Approaches

A third set of researchers has noted the lack of a relationship between cognitive ability and the use of specific study behaviors (e.g., Snow & Lohman, 1984). These researchers argue that as cognitive ability increases, students have an increasing array of available strategies to choose from and an increased ability to adapt their study strategy to the demands of the particular situation. This ability to adapt study behaviors to the demand characteristics of the particular learning tasks has been termed *metacognition* and *self-regulation ability* (e.g., Biggs, 1985; Gettinger & Seibert, 2002; Ley & Young, 1998). Flavell defines metacognitive processes as "one's knowledge concerning one's own cognitive processes and products . . . [and] the active monitoring and consequential regulation of those processes in relation to the cognitive objects or data on which they bear" (Flavell, 1976, p. 232). Students high in metacognitive and self-regulatory abilities are thought to be characterized by active involvement in their own learning process; continuous planning; and the careful monitoring of the task that they are required to complete, their own study behaviors, and the match between task and study behavior (B.J. Zimmerman, 1986). In addition, self-regulated learners seek assistance from peers and teachers, possess high self-efficacy and effective time management skills, and are goal directed and self-motivated (Ley & Young, 1998).

In aggregate, the literature suggests that SHSAs are multidimensional in nature (Gettinger & Seibert, 2002). Across all of the measures examined in this study, 10 commonly examined constructs or dimensions are evident. Collectively, the literature suggests that effective studying requires not only that the student possess knowledge of appropriate studying techniques and practices (study skills), but also sustained and deliberate effort

(study motivation), self-regulation, ability to concentrate, self-monitoring (study habits), and a sense of responsibility for and value in one's own learning (study attitude). In addition to these four constructs and the three level-of-processing constructs (deep approach, surface approach, achieving approach), some researchers also focused on metacognitive skills (discussed earlier) and study anxiety, which was assessed in some of the more commonly used inventories (e.g., LASSI). Study anxiety as used by the examined inventories, refers to feelings of tension and anxiety based on perceptions of low competence that accompany the act of studying. Like many early inventories, some more recently developed measures also report only an overall SHSA score, and we therefore included an aggregate SHSA construct in our analysis. Each of these 10 constructs is described in detail in Table 1.

It is important to note that our description of these 10 constructs serves primarily to highlight the most frequently encountered constructs in the broad SHSA literature. The degree to which these constructs are a complete and parsimonious representation of the overall construct space cannot be answered satisfactorily at this time. Very few studies have assessed students' scores across multiple inventories and/or constructs making it impossible to construct a meta-analytic matrix of construct intercorrelations. Indeed, we are aware of only a single (unpublished) study (Cole, 1988) that utilized both of the most frequently cited SHSA inventories (the SSHA and LASSI) and provided their intercorrelations. The evidence that is available does, however, suggest that some construct redundancy is likely to exist. For example, normative data of the LASSI (C.E. Weinstein & Palmer, 2002) shows substantial overlap between various subscales, with disattenuated correlations being as high as $\rho = .94$. The SHSA literature is likely to benefit from a more detailed examination of the discriminant validity of these constructs than is possible in a review of the published literature.

SHSAs and Academic Performance

The relationship between the various SHSA dimensions and subsequent academic performance has been considered from three perspectives: direct effects, mediational effects, and interactive effects. The first and most straightforward perspective conceptualizes SHSAs as direct measures of study-specific behaviors that cause academic success. This framework is applicable to some SHSA measures that ask about specific study behavior, but it is overly limiting for some of the attitudinal measures that are not likely to be proximal determinants of academic behaviors and success.

The mediational approach that we favor argues that SHSA measures quantify groups of academic specific attitudes and behavioral tendencies that are more proximal in their relationship to learning than are individual differences like personality, attitudes, and interests. The relationships between personality, attitude, and interests and academic performance are indirect

TABLE 1
Construct Description With Representative Measures

Category	Description	Representative measures of construct
Study skills	Ability to manage time and allocate other resources in accordance with the demands of the academic tasks, ability to organize, summarize, and integrate material.	Time management (LASSI), selecting main ideas (LASSI), fact retention (ILP), critical thinking (MSLQ), Tyler-Kimber Test of Study Skills, Boyington Study Skills Test, Study Methods and Systems (SAMS)
Study habits	Sound study routines, including, but not restricted to, frequency of studying sessions, review of material, self-testing, rehearsal of learned material, and studying in a conducive environment.	Study Habits Inventory, study habits (SSHA), rehearsal (MSLQ), cognitive monitoring (Study Activity Survey), Study Habits Test, reviewing subject matters (Study Behavior Questionnaire)
Study attitudes	A positive attitude toward education in general and studying in particular.	Study attitudes (SSHA), attitude (LASSI), academic interest/love of learning (SAMS), alienation toward authority (SAMS), ^a Student Attitudes Survey, giving priority to studies (College Adjustment and Study Skills Inventory)
Study anxiety	Anxiety attached to either the act of studying or taking of tests.	Anxiety (LASSI), test anxiety (MSLQ), study anxiety (SAMS)
Study motivation	Combination of both intrinsic and extrinsic motivation to engage in studying rather than other nonacademic activities.	Motivation (LASSI), motivation (Self-Regulation Questionnaire), academic drive, conformity (SAMS), working without prodding, motivation (Study Methods Scale)
Deep processing	Attempt to understand material and integrate it with one's existing knowledge structure to construct a global picture characterized by intrinsic motivation.	Deep approach (SPQ), deep processing (ILP), Deep Processing Scale, generation of constructed information (Study Activity Survey)
Surface processing	Reliance on rote learning and memorization that allows reproduction of learned material, characterized by extrinsic task motivation.	Surface approach (SPQ), surface approach (ASSISI), duplicative processing (Study Activity Survey), fact retention (ILP), reproducing orientation (Approaches to Studying Inventory)
Strategic processing	Focus is on achieving good grades through any means necessary, characterized by a systematic study routine that may be surface or deep in nature.	Strategic approach (SPQ), manipulation (SAMS), strategic approach (ASSISI)
Metacognitive skills	Awareness of studying process, monitoring of studying effectiveness, ability to adapt studying technique to suit situational demands.	Self-regulation (MSLQ), meta-cognitive strategy (self-regulation questionnaire), Executive Process Questionnaire
Aggregate measures	Broad measures of good study habits, study skills, study attitudes, and motivation.	Study orientation (SSHA), Study Methods Scale, LASSI total score, SAMS total score, College Adjustment and Study Skills Inventory, Study Habits and Attitudes Inventory

Note. LASSI = Learning and Study Skills Inventory; ILP = Inventory of Learning Processes; MSLQ = Motivated Strategies for Learning Questionnaire; SAMS = Study Attitudes and Methods Survey; SSHA = Survey of Study Habits and Attitudes; SPQ = Study Process Questionnaire; ASSISI = Strategic Systems-Based Integrated Sustainability Initiative.

^aReverse scored.

and mediated through their influence on SHSAs. For example, study anxiety would be a more proximal determinant of performance than would trait anxiety. In addition, some of the effects of cognitive ability would be predicted to be mediated through study skills but not study motivation. Finally, characteristics like typical intellectual engagement would be mediated through some types of study attitudes.

The framework we present here is an extension of both a general theory of work performance articulated by Campbell and colleagues (e.g., Campbell, 1990) and the application of this general theory to the academic performance domain (e.g., Kuncel, Hezlett, & Ones, 2001, 2004). The application of the Campbell model to the academic domain, and our extension of it to include SHSA constructs, is presented in Figure 1.

This model proposes that performance on a task is a function of three direct proximal determinants: declarative knowledge (knowledge of facts and procedures), procedural knowledge (the skill to do what is required in a situation), and motivation (the willingness to engage in and sustain a high level of effort in completing the task). The model is also characterized by a series of indirect and more distal determinants: cognitive ability; interests and personality; and education, training, and experience. The effects of these distal determinants on performance are fully mediated by the three direct determinants.

In other words, effective performance on a dimension of student performance is directly a function of task-relevant knowledge and skill and the immediate willingness to engage in a high level of effort that is sustained over time. The influence of all other individual differences are mediated through knowledge,

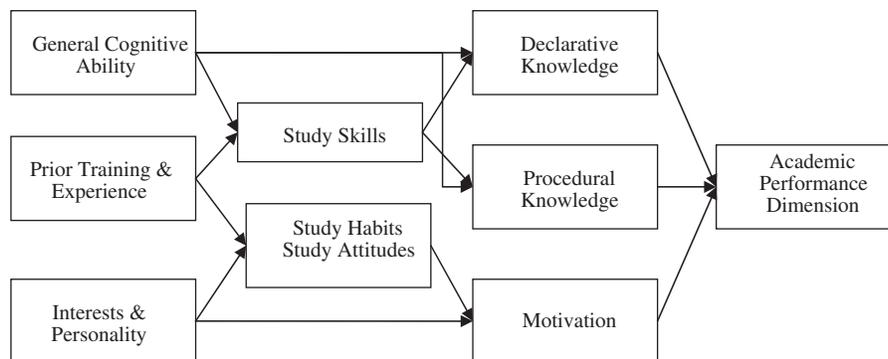


Fig. 1. Proposed model of academic performance determinants.

skill, and these specific motivational behaviors. For example, a high interest in mathematics is associated with a high grade in a mathematics examination, but this effect would be mediated by its influence on the acquisition of mathematical knowledge and skill and a willingness to use those skills to solve a problem.

Two additional aspects of this model are important to note. First, there are separate sets of direct and indirect determinants depending on the dimension of performance in question. For example, paper writing and studying for an exam would have different but overlapping sets of direct and indirect determinants. Effective performance in a student leadership role would have a different set of determinants than would avoiding drug and alcohol abuse. This is salient because recent empirical work has highlighted that academic performance is multidimensional and that predictors have differential relationships depending on the dimension of performance. For example Oswald et al. (2004) reviewed the educational objectives and mission statements of 35 colleges and universities and identified a number of academic performance dimensions, including leadership, interpersonal skills, and adaptability. Similarly, Kuncel and Hezlett (2007) demonstrated that all graduate admissions tests were positive predictors of an array of performance measure (e.g., research productivity, grades, faculty evaluations, degree attainment) but found that the magnitude of the relationship varied considerably depending on the nature of the performance domain.

Second, we make an important distinction between two stages of academic performance. The first stage includes the behind-the-scenes behaviors involving studying, time management, and avoidance of behaviors that are counterproductive for classroom success. This stage of performance determines the amount of knowledge and skill acquired. Successful performance at this stage involves effectively engaging in behaviors related to knowledge and skill acquisition, such as studying, communicating with peers, choosing to read at the library to avoid distractions, and so on. In the second stage, the accumulated knowledge and skill is assessed on exams, during presentations, and in written papers. Performance at this stage involves the actual evaluation (taking the exams, giving the presentation,

etc). Performance at the second stage determines grades and is the most observable aspect of student performance for faculty.

It is important to note that we have presented SHSA constructs as causal influences on academic performance. We acknowledge that such a causal sequence is, of course, impossible to establish in a meta-analytic review given the correlational nature of most of the published data. At the same time, a number of theoretical and empirical considerations suggest that a causal framework is not unreasonable. First, students must act to acquire knowledge (study, practice, integrate, retain) before it can be translated into performance on a test or exam, and extensive data from the experimental literature (summarized by Hattie et al., 1996) has shown that study skill training interventions can impact both study skill levels and academic performance. Second, a significant proportion of the SHSA literature has made use of predictive, rather than concurrent, research designs whereby SHSA data is gathered at one time point and academic performance data is gathered at a later time point (e.g., Ahmann & Glock, 1957; W.F. Brown & Holtzman, 1956, 1967; Culler & Holahan, 1980; Davenport, 1988; Holtzman, Brown, & Farquhar, 1954; Stockey, 1986). These studies have shown strong relationships between SHSA scores and future academic performance. Third, a causal mechanism is consistent with numerous other theoretical models of academic performance (e.g., Chartrand, 1990; Rossi & Montgomery, 1994; Tinto, 1975), including models that specifically position SHSA constructs as mediators of the relationship between intellectual and non-intellectual factors on the one hand and of academic performance on the other hand (e.g., Biggs, 1978; Elliot, McGregor, & Gable, 1999; Horn, Bruning, Schraw, Curry, & Katkanant, 1993; McKenzie & Gow, 2004).

Our model is, of course, an attempt to represent a highly complex phenomenon (student studying behavior and learning over a 15-week semester) in relatively parsimonious terms. As such, we have excluded numerous influences, processes, and variables that may also play a role. These warrant brief discussion. First, it is possible that the relationships between factors such as cognitive ability or study skills and academic performance are moderated or mediated by additional variables

that are not explicitly included in our model. Tinto's (1975) model of student attrition, for example, positions academic and social integration as mediators of the relationship between individual attributes (e.g., cognitive ability) and of the decision to drop out of university. Second, it is possible that some of the effects outlined in our model may in fact be bidirectional or recursive in nature: good study practices leading to higher academic performance that, in turn, act to reinforce those same good study practices, or poor academic performance acting as a motivator to change poor study practices. Finally, we also note that our individual difference model does not specify situational/contextual influences that almost certainly affect a student's level of academic performance. The social environment (e.g., social support, social integration) is an example of one domain that is likely to have effects above and beyond those of the individual difference variables that are included in our model.

SHSAs as Moderators

An alternate perspective (e.g., Hau & Salili, 1996) on the role of SHSAs in determining academic performance that has found some empirical support (e.g., De Sena, 1964; Lum, 1960; R.C. Myers, 1950; Waters, 1964) is that SHSAs act as moderators of the relationship between cognitive ability and academic performance. From this perspective, effective performance in college requires not only high cognitive ability, but also sound SHSAs. In the absence of good study skills and study habits, even students with high cognitive ability will do poorly, whereas good study skills and study habits allow students with high cognitive ability to perform well above students with low or medium cognitive ability levels. In other words, the relationship between cognitive ability and academic performance is likely to be strongly positive among students with high levels of SHSAs, whereas it is likely to be much weaker (although still positive) among students with low levels of SHSAs. This conceptualization of the role of SHSAs is also reflected in the study-skill training programs that universities have instituted to assist those students judged to be performing below their potential (e.g., Bahe, 1969; Giles-Gee, 1989; Hattie et al., 1996). This theoretical moderating role is illustrated in Figure 2.

Goals of this Article

Finding an explanation for unexpected student failures and successes in higher education is a high priority. SHSAs are not only likely candidates that can help account for these prediction errors they are also responsive to training, thus making their practical utility even greater. Therefore, the goals of this study are to provide comprehensive estimates of the predictive, incremental, and construct validity of SHSAs. More specifically, our goal here is to provide validity summaries for both scores on individual inventories of SHSAs and broader SHSA constructs,

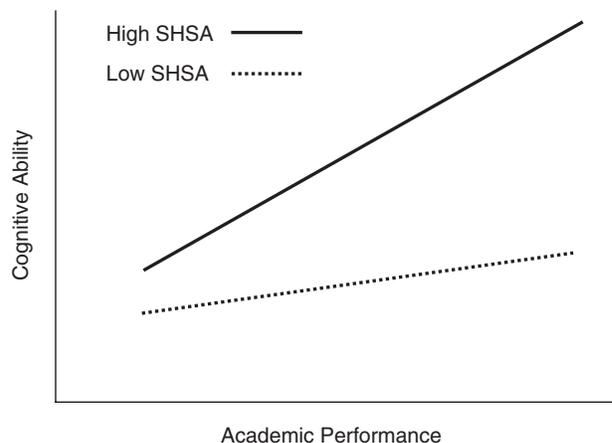


Fig. 2. Theoretical moderating role of SHSAs for the relationship between cognitive ability and academic performance.

as well as their relationships with traditional predictors and personality traits. Establishing the strengths of these relationships will allow us to estimate the degree to which SHSA constructs and inventories are able to account for variance in academic performance above and beyond that accounted for by traditional predictors and help clarify their place in a nomological network of individual differences.

METHOD

Literature Search

Possible sources of data for this study were identified via searches of the PsycINFO (1872–2005), Dissertations Abstracts (1980–2005), Education Full Text, and ERIC databases. Further possible data sources were obtained by examining the citation list of all examined journal articles, technical reports, and dissertations for additional promising sources.

Studies were only included in our analysis if they reported zero-order correlations between relevant criteria and SHSA predictors or if they presented statistics or data that could be transformed into correlations. A total of 19 studies that only reported statistically significant correlations between criteria and predictors were not included in our analysis. Including such studies would have resulted in an upwardly biased estimate of the relationship between academic performance and measures of study habits, study skills, and study attitudes. The database was also closely examined to ensure that only one element of any overlapping samples (e.g., dissertations that were later published as journal articles) was included in our analyses.

Coding Procedures

The coding of all articles, reports, and dissertations was systematized via the use of strict coding procedures and coding sheets. These sheets facilitate the capture of all relevant data and cue the coder to attend to important study information. Marcus Credé did all coding of validity and ability correlations,

and Nathan R. Kuncel completed accuracy checks on a small portion of the coded material and coded personality correlates.

All predictor–criterion correlations were coded and entered into an Excel spreadsheet. Other important study information was also captured. This included study design (predictive, concurrent, and retrospective), sample characteristics (gender, ethnicity, age, year in college, and major), time lag between collection of predictor and collection of criterion, type of university at which data was collected (public or private), as well as year of publication.

Intercorrelations among the predictor variables and correlations between predictor variables and traditional cognitive predictors of college performance and personality constructs were also coded. Intercorrelations among predictor variables, such as correlations among the subscales of a test, allow unit-weighted composites to be formed from subscale level data. Intercorrelations between predictor variables and cognitive ability tests allow an examination of the degree to which the study habit predictors explain incremental variance in college performance over and above the variance explained by standard cognitive admissions tests such as the SAT and ACT.

Final Database

After composites were formed and unusable data was excluded, the database for the relationships between SHSAs and academic performance consisted of 961 correlations from 344 independent samples representing 72,431 college students. In addition, 424 correlations between SHSA predictors and cognitive ability tests and 80 correlations between SHSAs and personality tests were also coded.

Predictor Categories

The study habits literature is highly diverse in terms of both the measures of study habits and study skills that are used and the criteria that are considered. Given the range of variables and existence of a multidimensional predictor space, we considered it inappropriate to collapse all SHSA inventories into a single category or to equate all academic performance criteria. Therefore, we followed a dual meta-analytic strategy. First, we conducted separate analyses for SHSA inventories for which sufficient validity information was provided (at least five samples for each criterion). Second, we grouped inventories and their subscales into broader construct categories according to the content of the subscales. This was done on the basis of scale descriptions and item content. In addition to the 10 broad SHSA constructs summarized in Table 1, we also analyzed the relationship between academic performance and measures of the amount of time spent studying—a commonly examined relationship.

Criterion Categories

The large numbers of different criteria used by researchers in this area were grouped into four categories to facilitate analysis: first-semester freshman GPA, freshman GPA, general GPA, and performance in individual classes. First-semester GPA was also included in the freshman GPA category, which in turn was also included in the general GPA category. For some inventories and for some SHSA categories, separate analyses could not be conducted for all four of these criterion groups due to insufficient validity information ($k < 5$).

Personality Categories

Numerous researchers have investigated the relationship between students' SHSAs and various personality constructs. To facilitate meta-analytic aggregation, we grouped personality measures into constructs using the taxonomy of personality scales developed by Hough and Ones (2001). Sufficient data was available to allow analysis between study habits and study attitudes and eight personality constructs: achievement motivation, neuroticism, external locus of control, internal locus of control, extroversion, openness to experience, conscientiousness, and self-concept.

ANALYTIC PROCEDURE

We used the Hunter and Schmidt (1990, 2004) psychometric meta-analytic method in this study. This method allows estimation of the amount of variance attributable to sampling error and artifacts such as unreliability in both the predictor and criterion variables. In addition, this method also provides the best estimate of the population correlation between the predictors (SHSAs) and criteria (GPA, course achievement) in the absence of measurement error. As not all studies included in our database reported the necessary measurement error information, this study relied on the existing research literature to construct appropriate artifact distributions and then used the interactive meta-analytic procedure (Hunter & Schmidt, 1990) to improve the accuracy of the results. Artifact distribution information for unreliability in both the criterion and predictor are presented in Table 2. The reliability of grades was based on internal consistency reliabilities from three studies of college grades from Barritt (1966), Bendig (1953), and Reilly and Warech (1993). Corrections for unreliability in the predictor variable were only conducted when reliability information was available for scores on the specific inventory. For inventories in which no reliability information was available (e.g., Study Habits and Attitudes Inventory, Taylor-Kimber Study Skills Test), we made no corrections for unreliability. In the case of the SSHA, we used two separate reliability distributions. The first was based on test–retest reliability data, and the second was based on indicators of internal consistency (Cronbach's alpha).

TABLE 2
Reliability Artifact Distributions for SHSA Constructs and GPA Criterion

Categories	$M r_{xx}$	$SD r_{xx}$	k_{rel}
Predictors			
Aggregate measures	0.82	0.10	15
Study habits	0.83	0.07	30
Study skills	0.71	0.07	23
Study attitudes	0.83	0.09	12
Study motivation	0.71	0.09	18
Study anxiety	0.75	0.05	11
Deep processing	0.68	0.09	24
Surface processing	0.64	0.09	16
Strategic processing	0.73	0.09	12
Metacognitive skills	0.79	0.06	7
Criterion			
First-semester freshman GPA	0.83	0.02	3
Freshman GPA	0.83	0.02	3
GPA	0.83	0.02	3

Note. SHSA = Survey of Study Habits and Attitudes; $M r_{xx}$ = mean of reliability distribution; $SD r_{xx}$ = standard deviation of reliability distribution; k_{rel} = number of independent reliability coefficients on which distributions are based.

The reliability artifact distributions for the SSHA and LASSI are presented in Table 3.

For the cases in which subscale composites were formed into overall scales, we calculated Mosier (1943) reliability estimates when subscale intercorrelations were available and used the mean of the subscale reliabilities if the intercorrelations were not available.

For each construct category, we weighted the available reliability data for scores on each scale by frequency to match the frequency with which scales occurred with the frequency of their corresponding reliability estimates. That is, reliability information for scores on frequently studied inventories such as the SSHA and LASSI were included proportionately more often in the artifact distribution.

In addition to the population correlation (ρ), this study also provides estimates of the operational validity of scores on the most commonly used measures of study skills and study habits. Operational validity refers to the test–criterion correlation coefficient that has been corrected for unreliability in the criterion, but not in the predictor. Because admissions and counseling decisions are made with an imperfectly reliable measure, we used a constant level of unreliability to estimate the operational validity of scores on specific tests.

Correcting the sample size weighted mean observed correlation (r_{obs}) and the observed standard deviation (SD_{obs}) for measurement error and measurement error variability, respectively, yields more accurate estimates of the relationship between two variables. Furthermore, such corrections permit us to evaluate if the variability in observed correlations is due to systematic artifactual biases or if it reflects the existence of substantive

TABLE 3
Reliability Artifact Distributions for SSHA and LASSI Subscales

Scale	Subscale	Alpha distribution			Test–retest distribution		
		$M r_{xx}$	$SD r_{xx}$	k_{rel}	$M r_{xx}$	$SD r_{xx}$	k_{rel}
SSHA	Delay avoidance	.82	.11	2	.72	.13	6
SSHA	Work methods	.82	.07	2	.71	.10	6
SSHA	Study habits	.93	.00	2	.78	.09	6
SSHA	Teacher approval	.84	.05	2	.64	.14	6
SSHA	Educational experience	.77	.15	2	.69	.11	6
SSHA	Study attitudes	.88	.06	2	.74	.12	6
SSHA	Study orientation	.93	.03	2	.76	.11	7
LASSI	Attitude	.72	.03	8	—	—	—
LASSI	Motivation	.76	.06	8	—	—	—
LASSI	Time management	.79	.06	8	—	—	—
LASSI	Anxiety	.78	.05	8	—	—	—
LASSI	Concentration	.80	.06	8	—	—	—
LASSI	Information processing	.77	.03	8	—	—	—
LASSI	Selecting main ideas	.70	.04	8	—	—	—
LASSI	Study aids	.62	.11	8	—	—	—
LASSI	Self-testing	.74	.05	8	—	—	—
LASSI	Test strategies	.75	.06	8	—	—	—

Note. SHSA = Survey of Study Habits and Attitudes; LASSI = Learning and Study Skills Inventory; $M r_{xx}$ = mean of reliability distribution; $SD r_{xx}$ = standard deviation of reliability distribution; k_{rel} = number of independent reliability coefficients on which distributions are based.

moderators. Moreover, correcting SD_{obs} for the occasionally massive differences in sample sizes across studies yields a more accurate estimate of whether or not the differences observed in the literature are merely the result of sampling error.

We also applied corrections for unreliability when computing variability estimates across the correlations included in each meta-analysis. The standard deviation of observed correlations corrected for statistical artifacts is the residual standard deviation (SD_{res}). The standard deviation of the true score validities (SD_{ρ}) describes the standard deviation associated with the true validity after variability due to sampling error, unreliability in the predictor, unreliability in the criterion, and range restriction have been removed. The magnitude of SD_{ρ} is an indicator for the presence of moderators. Smaller values suggest that other variables are unlikely to substantially moderate the validity of scores on the predictor of interest. If all or a major portion of the observed variance in a correlation is due to statistical artifacts, one can conclude that the relationship is constant or nearly so.

The SD_{ρ} was also used to compute a lower bound of the 90% credibility interval, which is used as an indicator of the likelihood that the true relationship generalizes across situations. If the lower 90% credibility value is greater than zero, one can conclude that the presence of a relationship can be generalized to new situations (Hunter & Schmidt, 1990). In this meta-analysis, if the 90% credibility value is greater than zero, but

TABLE 4
Meta-Analytic Results for the SSHA for Freshman GPA

Reliability	Subscale	<i>N</i>	<i>k</i>	<i>r</i> _{obs}	<i>SD</i> _{obs}	<i>r</i> _{op}	<i>SD</i> _{op}	ρ	<i>SD</i> _{ρ}	Lower 90%	Upper 90%
Test-retest	Delay avoidance	4,163	20	.27	.09	.30	.06	.36	.07	.20	.40
Test-retest	Work methods	4,163	20	.26	.11	.29	.09	.34	.11	.14	.44
Test-retest	Study habits	4,642	23	.28	.12	.31	.11	.35	.12	.13	.49
Test-retest	Teacher approval	4,163	20	.20	.09	.22	.07	.28	.08	.10	.36
Test-retest	Educational acceptance	4,163	20	.30	.09	.33	.07	.39	.08	.21	.45
Test-retest	Study attitudes	4,642	23	.26	.10	.29	.08	.33	.10	.16	.42
Test-retest	Study orientation	5,500	33	.29	.13	.32	.11	.36	.13	.14	.50
Alpha	Delay avoidance	4,163	20	.27	.09	.30	.06	.33	.07	.20	.40
Alpha	Work methods	4,163	20	.26	.11	.29	.09	.32	.10	.14	.44
Alpha	Study habits	4,642	23	.28	.12	.31	.11	.33	.12	.13	.49
Alpha	Teacher approval	4,163	20	.20	.09	.22	.07	.24	.07	.10	.34
Alpha	Educational acceptance	4,163	20	.30	.09	.33	.07	.37	.08	.21	.45
Alpha	Study attitudes	4,642	23	.26	.10	.29	.09	.30	.09	.16	.42
Alpha	Study orientation	5,500	33	.29	.13	.32	.11	.33	.12	.14	.50

Note. SSHA = Survey of Study Habits and Attitudes; *k* = number of studies; *r*_{obs} = sample size weighted mean observed correlation; *SD*_{obs} = observed standard deviation; *r*_{op} = operational validity; *SD*_{op} = standard deviation of operational validity; ρ = true score correlation; *SD* _{ρ} = standard deviation of true score correlation; lower 90% = lower bound of 90% credibility interval based on operational validity; upper 90% = upper bound of 90% credibility interval based on operational validity; test-retest = ρ and *SD* _{ρ} based on test-retest reliability data; alpha = ρ and *SD* _{ρ} based on alpha reliability data.

variance in the correlations remains after corrections, it can be concluded that the relationships of study skills and study habits with relevant criteria are positive across situations, although the actual magnitude may vary somewhat across settings. However, the remaining variability may also be due to uncorrected statistical artifacts, other methodological differences, and unidentified moderators. All of these interpretations of *SD* _{ρ} and the credibility interval are based on the assumption that the studies included in the meta-analysis are randomly sampled from a population of samples, situations, and instruments. Although

our database represents a very wide range of samples, situations, and instruments, the existing literature is a study-level convenience sample of convenience samples. Therefore, our estimates of variability may be over or under estimates.

RESULTS

Results for SSHA

The meta-analytic results for the SSHA are presented in Tables 4, 5, and 6 and include meta-analytic estimates of the observed

TABLE 5
Meta-Analytic Results for the SSHA for General GPA

Reliability	Subscale	<i>N</i>	<i>k</i>	<i>r</i> _{obs}	<i>SD</i> _{obs}	<i>r</i> _{op}	<i>SD</i> _{op}	ρ	<i>SD</i> _{ρ}	Lower 90%	Upper 90%
Test-retest	Delay avoidance	5,601	32	.28	.11	.30	.09	.36	.10	.15	.45
Test-retest	Work methods	5,601	32	.26	.13	.28	.12	.33	.14	.08	.48
Test-retest	Study habits	6,259	40	.28	.14	.30	.13	.34	.15	.09	.51
Test-retest	Teacher approval	5,651	33	.18	.10	.20	.08	.25	.10	.07	.33
Test-retest	Educational acceptance	6,601	32	.29	.11	.31	.09	.38	.11	.16	.46
Test-retest	Study attitudes	6,309	41	.24	.13	.26	.11	.31	.13	.08	.44
Test-retest	Study orientation	12,250	83	.30	.22	.33	.22	.38	.25	-.03	.69
Alpha	Delay avoidance	5,601	32	.28	.11	.30	.09	.34	.10	.15	.45
Alpha	Work methods	5,601	32	.26	.13	.28	.12	.31	.13	.08	.48
Alpha	Study habits	6,259	40	.28	.14	.30	.13	.33	.14	.09	.51
Alpha	Teacher approval	5,651	33	.18	.10	.20	.08	.22	.08	.07	.33
Alpha	Educational acceptance	6,601	32	.29	.11	.31	.09	.36	.11	.16	.46
Alpha	Study attitudes	6,309	41	.24	.13	.26	.11	.26	.11	.08	.44
Alpha	Study orientation	12,250	83	.30	.22	.33	.22	.34	.23	-.03	.69

Note. SSHA = Survey of Study Habits and Attitudes; *k* = number of studies; *r*_{obs} = sample size weighted mean observed correlation; *SD*_{obs} = observed standard deviation; *r*_{op} = operational validity; *SD*_{op} = standard deviation of operational validity; ρ = true score correlation; *SD* _{ρ} = standard deviation of true score correlation; Lower 90% = lower bound of 90% credibility interval based on operational validity; Upper 90% = upper bound of 90% credibility interval based on operational validity; test-retest = ρ and *SD* _{ρ} based on test-retest reliability data, alpha = ρ and *SD* _{ρ} based on alpha reliability data.

TABLE 6
Meta-Analytic Results for the SSHA for Performance in Individual Classes

Reliability	Subscale	<i>N</i>	<i>k</i>	<i>r</i> _{obs}	<i>SD</i> _{obs}	<i>r</i> _{op}	<i>SD</i> _{op}	ρ	<i>SD</i> _{ρ}	Lower 90%	Upper 90%
Test–retest	Delay avoidance	671	8	.20	.14	.20	.09	.24	.11	.05	.35
Test–retest	Work methods	671	8	.23	.16	.23	.11	.27	.14	.05	.41
Test–retest	Study habits	881	11	.23	.16	.23	.12	.26	.14	.03	.43
Test–retest	Teacher approval	981	9	.13	.14	.13	.10	.17	.12	–.03	.29
Test–retest	Educational acceptance	983	9	.12	.15	.12	.12	.14	.14	–.08	.32
Test–retest	Study attitudes	1,145	11	.14	.15	.14	.11	.15	.12	–.04	.32
Test–retest	Study orientation	1,915	17	.23	.15	.23	.11	.26	.13	.05	.41
Alpha	Delay avoidance	671	8	.20	.14	.20	.09	.23	.10	.05	.35
Alpha	Work methods	671	8	.23	.16	.23	.12	.25	.13	.05	.41
Alpha	Study habits	881	11	.23	.16	.23	.12	.25	.13	.03	.43
Alpha	Teacher approval	981	9	.13	.14	.13	.10	.14	.11	–.03	.29
Alpha	Educational acceptance	983	9	.12	.15	.12	.12	.13	.14	–.08	.32
Alpha	Study attitudes	1,145	11	.14	.15	.14	.11	.14	.11	–.04	.32
Alpha	Study orientation	1,915	17	.23	.15	.23	.11	.24	.12	.05	.41

Note. SSHA = Survey of Study Habits and Attitudes; *k* = number of studies; *r*_{obs} = sample size weighted mean observed correlation; *SD*_{obs} = observed standard deviation; *r*_{op} = operational validity; *SD*_{op} = standard deviation of operational validity; ρ = true score correlation; *SD* _{ρ} = standard deviation of true score correlation; Lower 90% = lower bound of 90% credibility interval based on operational validity; Upper 90% = upper bound of 90% credibility interval based on operational validity; test–retest = ρ and *SD* _{ρ} based on test-retest reliability data; alpha = ρ and *SD* _{ρ} based on alpha reliability data.

correlations, the operational validities (corrected for unreliability in the criterion), and the population correlation (corrected for unreliability in both the criterion and the SSHA predictor). Given that the literature provides estimates of both test–retest reliability and measures of internal consistency, we performed two separate sets of analyses using two different reliability distributions. The SSHA operational validities for freshman GPA were moderately large, ranging from $\rho = .22$ for teacher approval (*N* = 4,163, *k* = 20) to $\rho = .33$ for educational acceptance (*N* = 4,163, *k* = 20). The range of operational validities was similar for the general GPA criterion, ranging from $\rho = .20$ for teacher approval (*N* = 5,651, *k* = 33) to $\rho = .33$ for study orientation (*N* = 12,250, *k* = 83). The smallest operational validities were observed for performance in individual courses, partly because we did not correct for the unreliability of individual grades. Using the test–retest reliability estimates for the first-year GPA criterion, we found that the population correlation estimates ranged from $\rho = .28$ for teacher approval (*N* = 4,163, *k* = 20) to $\rho = .39$ for educational acceptance (*N* = 4,163, *k* = 20). For the general GPA criterion, an almost identical range of population correlation estimates were observed, ranging from a low of .25 for teacher approval (*N* = 5,651, *k* = 33) to a high of $\rho = .38$ for educational acceptance (*N* = 5,601, *k* = 32) and for the aggregate measure of study orientation (*N* = 12,250, *k* = 83). The population correlation estimates for the relationship between SSHA scales and individual class grades were lower, ranging from $\rho = .14$ for educational acceptance (*N* = 983, *k* = 6) to $\rho = .27$ for work methods (*N* = 671, *k* = 8). The observed internal consistency estimates were slightly higher than the observed test–retest reliability estimates, resulting in the population correlation estimates being slightly

lower when using the artifact distributions based in internal consistency measures.

Results for LASSI

The meta-analytic results for the LASSI are presented in Table 7 and include meta-analytic estimates of the observed correlations, the operational validities (corrected for unreliability in the criterion), and the population correlations (corrected for unreliability in both the criterion and the LASSI predictor).

The operational validities for freshman GPA in the LASSI subscales ranged from $\rho = .14$ for information processing (*N* = 961, *k* = 6) to $\rho = .34$ for motivation (*N* = 961, *k* = 6). A similar range of validities was observed for the general GPA criterion. The lowest validity of $\rho = .16$ was observed for informational processing (*N* = 3,287, *k* = 16), with the highest validity of $\rho = .34$ for the motivation subscale (*N* = 3,287, *k* = 16). Estimates of the population correlation ranged from $\rho = .16$ for information processing to $\rho = .40$ for motivation for freshman GPA and from $\rho = .18$ for information processing to $\rho = .38$ for motivation for the general GPA criterion.

Results for Other Scales

The meta-analytic results for scales used less widely than the LASSI and SSHA are presented in Table 8. We used broad academic performance as the criterion for each of these analyses and included both GPAs and performance in individual classes. Validity coefficients for the Inventory of Learning Processes were low to moderate, ranging from a low of $\rho = .11$ for the study methods subscale (*N* = 1,900, *k* = 11) to $\rho = .29$ for synthesis analysis (*N* = 1,900, *k* = 11). A similar range of validity

TABLE 7
Meta-Analytic Results for the LASSI for First-Year GPA, and General GPA

Subscale	Freshman GPA										General GPA									
	<i>N</i>	<i>k</i>	<i>r</i> _{obs}	<i>SD</i> _{obs}	<i>r</i> _{op}	<i>SD</i> _{op}	ρ	<i>SD</i> _{ρ}	Lower 90%	Upper 90%	<i>N</i>	<i>k</i>	<i>r</i> _{obs}	<i>SD</i> _{obs}	<i>r</i> _{op}	<i>SD</i> _{op}	ρ	<i>SD</i> _{ρ}	Lower 90%	Upper 90%
Attitude	961	6	.23	.14	.25	.13	.30	.15	.04	.46	3,287	16	.21	.12	.23	.10	.27	.12	.07	.39
Motivation	961	6	.31	.12	.34	.10	.40	.12	.18	.50	3,287	16	.30	.13	.34	.12	.38	.13	.14	.54
Time Management	961	6	.23	.10	.25	.08	.28	.09	.12	.38	3,287	16	.21	.09	.23	.07	.26	.07	.11	.35
Anxiety	961	6	.15	.14	.16	.13	.18	.14	-.05	.37	3,287	16	.18	.10	.19	.09	.22	.10	.04	.34
Concentration	961	6	.23	.14	.25	.12	.28	.14	.05	.45	3,287	16	.24	.10	.26	.08	.29	.08	.13	.39
Information processing	961	6	.13	.11	.14	.08	.16	.08	.01	.27	3,287	16	.14	.10	.16	.08	.18	.10	.03	.29
Selecting main ideas	961	6	.16	.11	.17	.08	.20	.10	.04	.30	3,287	16	.15	.09	.17	.07	.20	.08	.05	.29
Study aids	961	6	.16	.05	.17	.00	.22	.00	.17	.17	3,287	16	.14	.07	.16	.02	.20	.02	.13	.19
Self-testing	961	6	.24	.06	.27	.00	.31	.00	.27	.27	3,287	16	.19	.08	.21	.04	.24	.04	.14	.28
Test strategies	961	6	.23	.15	.25	.13	.25	.13	.04	.45	3,287	16	.24	.11	.27	.10	.31	.12	.11	.43

Note. LASSI = Learning and Study Skills Inventory; *k* = number of studies; *r*_{obs} = sample size weighted mean observed correlation; *SD*_{obs} = observed standard deviation; *r*_{op} = operational validity; *SD*_{op} = standard deviation of operational validity; ρ = true score correlation; *SD* _{ρ} = standard deviation of true score correlation; lower 90% = lower bound of 90% credibility interval based on operational validity; upper 90% = upper bound of 90% credibility interval based on operational validity.

coefficients was observed for the Study Attitudes and Methods Survey. The weakest relationship with academic performance in this scale was found in the manipulation subscale ($\rho = -.04$, $N = 880$, $k = 7$), and the strongest relationship was found in the academic interest subscale ($\rho = .24$, $N = 880$, $k = 7$). The validity coefficients of the study methods scale were also low to moderate in size for all subscales, ranging from $\rho = .14$ for the lack of distractions subscale ($N = 1,650$, $k = 6$) to $\rho = .31$ for the motivation subscale ($N = 1,650$, $k = 6$). A high correlation was observed between academic performance and the Study Habits and Attitudes Inventory, a precursor to the SSHA, with an operational validity of $\rho = .54$ ($N = 1,015$, $k = 9$). No reliability data was available for this inventory, and the observed correlations could thus not be disattenuated for predictor unreliability. Another inventory in which we found a high validity coefficient of $\rho = .48$ but no available reliability information is the Tyler-Kimber Study Skills Test ($N = 752$, $k = 5$). Finally, the validity of scores on the Study Process Questionnaire was uniformly low with the strongest observed validity coefficient of $\rho = -.14$ for the surface strategy subscale ($N = 1,450$, $k = 7$).

Results for Time Spent Studying

The meta-analytic results relating to the amount of time spent studying by students are presented in Table 9. Across all three analyses, the validity coefficients were low but positive. The size of the relationships ranged from a low of $\rho = .01$ for individual grades to $\rho = .15$ for the overall GPA criterion ($N = 19,042$, $k = 51$) to a high of $\rho = .21$ for the freshman GPA criterion ($N = 4,152$, $k = 11$).

Results for Construct Categories

The meta-analyses for the relationship between the 10 SHSA constructs and the four academic performance criteria are presented in Tables 10, 11, and 12, respectively. Analyses were not possible for all criterion–predictor combinations given the lack of available data. Validity coefficients were highest for the aggregate measure category, ranging from a low of $\rho = .22$ for performance in individual classes ($N = 1,655$, $k = 13$) to a high of $\rho = .41$ for general GPA ($N = 18,517$, $k = 107$). Relatively large validity coefficients were also observed for the study skills, study habits, study attitudes, and study motivation construct categories. Validity coefficients for these four constructs with general GPA were $\rho = .33$ for study skills ($N = 24,547$, $k = 87$), $\rho = .28$ for study habits ($N = 23,390$, $k = 102$), $\rho = .31$ for study attitudes ($N = 7,211$, $k = 37$), and $\rho = .30$ for study motivation ($N = 6,157$, $k = 25$). The validity coefficients for the deep, surface, and strategic approaches were uniformly low with all credibility intervals including zero.

Relationships With Traditional Predictors of Academic Performance

Tables 13, 14, and 15 present meta-analytic estimates of the relationship that SHSA constructs and the SSHA exhibit with both high school GPA (HSGPA) and scores on college admissions tests such as the SAT and ACT. A lack of sufficient data meant that scale relationships with HSGPA and admissions test scores could only be examined at the construct level and for the SSHA.

The meta-analytic relationships between the SHSA constructs and admissions test scores were generally low, with the

TABLE 8
Meta-Analyses of the Relationship Between Academic Performance and SHSA Inventories

Scale	Subscale	<i>N</i>	<i>k</i>	<i>r</i> _{obs}	<i>SD</i> _{obs}	<i>r</i> _{op}	<i>SD</i> _{op}	ρ	<i>SD</i> _{ρ}	Lower 90%	Upper 90%
ILP	Synthesis analysis	1,900	11	.22	.16	.24	.16	.29	.18	-.02	.50
ILP	Study methods	1,900	11	.09	.13	.10	.13	.11	.14	-.11	.31
ILP	Fact retention	1,900	11	.17	.09	.18	.06	.25	.08	.08	.28
ILP	Elaborative processing	1,900	11	.17	.12	.18	.10	.24	.18	.02	.34
SAMS	Academic interest	880	7	.18	.12	.20	.08	.24	.10	.08	.41
SAMS	Academic drive	880	7	.11	.12	.12	.09	.14	.10	-.03	.31
SAMS	Study methods	880	7	.13	.13	.15	.10	.18	.13	-.03	.39
SAMS	Study anxiety	880	7	-.12	.16	-.14	.15	-.16	.17	-.44	.12
SAMS	Manipulation	880	7	-.07	.13	-.07	.11	-.09	.13	-.30	.12
SAMS	Alienation	880	7	-.03	.16	-.03	.14	-.04	.17	-.32	.24
SHAI	Total	1,015	9	.49	.04	.54	.00	.54	.00	.54	.54
Study Habits Inventory	Total	2,890	20	.21	.11	.24	.08	.27	.10	.11	.37
Study Methods Scale	Study methods	1,650	6	.21	.06	.23	.00	.27	.00	.23	.23
Study Methods Scale	Motivation	1,650	6	.21	.04	.23	.00	.31	.00	.23	.23
Study Methods Scale	Lack of distractions	1,650	6	.11	.06	.12	.02	.14	.03	.09	.15
Study Methods Scale	Exam technique	1,650	6	.18	.03	.19	.00	.25	.00	.19	.19
Taylor–Kimber	Total	752	5	.44	.10	.48	.08	.48	.08	.35	.61
SPQ	Surface motivation	1,447	7	-.05	.12	-.05	.11	-.08	.16	-.23	.13
SPQ	Surface strategy	1,450	7	-.10	.08	-.10	.05	-.14	.07	-.18	-.02
SPQ	Surface approach	2,524	14	-.09	.10	-.10	.07	-.12	.09	-.22	.02
SPQ	Deep motivation	1,160	6	.05	.14	.06	.13	.07	.16	-.15	.27
SPQ	Deep strategy	1,165	6	.03	.10	.04	.08	.05	.10	-.09	.17
SPQ	Deep approach	2,531	14	.06	.15	.07	.14	.08	.16	-.16	.30
SPQ	Achievement motivation	1,446	7	.07	.14	.08	.14	.10	.17	-.15	.31
SPQ	Achievement strategy	1,451	7	.07	.13	.08	.12	.09	.14	-.12	.28
SPQ	Achievement approach	2,239	13	.074	.18	.07	.18	.09	.21	-.23	.37

Note. No reliability data was available for the SHAI and the Tyler–Kimber and no corrections for scale unreliability were therefore conducted. SHSA = Survey of Study Habits and Attitudes; *k* = number of studies; *r*_{obs} = sample size weighted mean observed correlation; *SD*_{obs} = observed standard deviation; *r*_{op} = operational validity; *SD*_{op} = standard deviation of operational validity; ρ = true score correlation; *SD* _{ρ} = standard deviation of true score correlation; lower 90% = lower bound of 90% credibility interval based on operational validity; upper 90% = upper bound of 90% credibility interval based on operational validity. ILP = Inventory of Learning Processes; SHAI = Study Habits and Attitudes Inventory; Taylor–Kimber = Taylor–Kimber Study Skills Test; SPQ = Study Process Questionnaire.

highest observed correlations being $\rho = .25$ for meta-cognition (*N* = 408, *k* = 2) and $\rho = .23$ for study skills (*N* = 6,297, *k* = 21). Similar weak relationships were also observed for the relationships with HSGPA. The strongest observed correlation with HSGPA was $\rho = .26$ for time spent studying (*N* = 2,326, *k* = 3). The low relationships between SHSA constructs and traditional cognitive predictors of college performance suggest

that SHSA predictors would explain significant and meaningful variance in college academic performance above and beyond that explained by admissions criteria such as HSGPA and SAT/ACT scores.

The observed relationship between the SHSA subscales and admissions test scores were also low, ranging from $\rho = .00$ for delay avoidance (*N* = 3,662, *k* = 14) to .24 for work methods

TABLE 9
Meta-Analyses of the Relationship Between the Amount of Time Spent Studying and Freshman GPA, Overall GPA, and Performance in Individual Classes

Criterion	<i>N</i>	<i>k</i>	<i>r</i> _{obs}	<i>SD</i> _{obs}	<i>r</i> _{op}	<i>SD</i> _{op}	ρ	<i>SD</i> _{ρ}	Lower 90%	Upper 90%
Freshman GPA	4,152	11	.19	.14	.21	.14	.21	.14	-.02	.44
Overall GPA	17,242	50	.15	.20	.16	.21	.16	.21	-.21	.21
Performance in individual classes	1,615	17	.01	.11	.01	.05	.01	.05	-.07	.09

Note. *k* = number of studies; *r*_{obs} = sample size weighted mean observed correlation; *SD*_{obs} = observed standard deviation; *r*_{op} = operational validity; *SD*_{op} = standard deviation of operational validity; ρ = true score correlation; *SD* _{ρ} = standard deviation of true score correlation; lower 90% = lower bound of 90% credibility interval based on operational validity; upper 90% = upper bound of 90% credibility interval based on operational validity.

TABLE 10
Meta-Analyses for the Relationships Between the 10 SHSA Constructs and First-Semester GPA and Freshman GPA

Construct	First-Semester GPA										Freshman GPA									
	<i>N</i>	<i>k</i>	<i>r</i> _{obs}	<i>SD</i> _{obs}	<i>r</i> _{op}	<i>SD</i> _{op}	ρ	<i>SD</i> _{ρ}	Lower 90%	Upper 90%	<i>N</i>	<i>k</i>	<i>r</i> _{obs}	<i>SD</i> _{obs}	<i>r</i> _{op}	<i>SD</i> _{op}	ρ	<i>SD</i> _{ρ}	Lower 90%	Upper 90%
Aggregate measures	5,581	37	.33	.13	.37	.12	.40	.13	.17	.57	6,613	44	.32	.13	.35	.12	.39	.13	.15	.55
Study skills	3,751	18	.26	.15	.28	.14	.34	.17	.05	.51	7,782	34	.25	.15	.28	.15	.33	.18	.03	.53
Study habits	6,922	34	.24	.13	.26	.12	.28	.13	.06	.46	9,693	47	.22	.13	.24	.12	.27	.13	.14	.44
Study attitudes	—	—	—	—	—	—	—	—	—	—	3,435	17	.27	.14	.29	.13	.32	.14	.08	.50
Study motivation	—	—	—	—	—	—	—	—	—	—	1,953	13	.30	.11	.33	.09	.39	.11	.18	.48
Study anxiety	—	—	—	—	—	—	—	—	—	—	1,210	9	-.14	.15	-.15	.14	-.18	.15	-.43	.07
Deep approach	—	—	—	—	—	—	—	—	—	—	2,414	8	.16	.11	.18	.11	.22	.13	.00	.36

Note. SHSA = Survey of Study Habits and Attitudes; *k* = number of studies; *r*_{obs} = sample size weighted mean observed correlation; *SD*_{obs} = observed standard deviation; *r*_{op} = operational validity; *SD*_{op} = standard deviation of operational validity; ρ = true score correlation; *SD* _{ρ} = standard deviation of true score correlation; lower 90% = lower bound of 90% credibility interval based on operational validity; upper 90% = upper bound of 90% credibility interval based on operational validity.

(*N* = 3,662, *k* = 14). The relationship for the overall score (study orientation) and admissions test scores was also low at ρ = .16 (*N* = 6,710, *k* = 23). This together with the high validity of scores on the SSHA discussed earlier suggests that this inventory would be particularly useful in predicting academic performance above and beyond traditional cognitive predictors of college performance.

Incremental Validity

Also included in Tables 13, 14, and 15 is the incremental *R* provided by SHSA constructs and SSHA subscales in predicting freshman GPA over and above both HSGPA and admissions test scores. Incremental validity was calculated using hierarchical linear regression and existing meta-analytic estimates of the relationship between SAT scores and HSGPA and freshmen GPA

(Hezlett et al., 2001). The operational validity of .35 for SAT scores and of .40 for HSGPA was used for these calculations.

For the SHSA constructs, the highest incremental *R* values are for the aggregate measures of study skills, study habits, study attitudes, and study motivation, with incremental *R*s for these four constructs ranging from .04 to .12. For the SSHA subscales, incremental *R*s ranged from .04 for the teacher approval subscale to .11 for both delay avoidance and educational acceptance.

Relationship With Personality Constructs

Table 16 presents the relationships between the eight personality constructs and study habits and study attitudes. A lack of information in the summarized literature regarding the reliability of the utilized personality scales prevented us from cor-

TABLE 11
Meta-Analyses for the Relationships Between the 10 SHSA Constructs and General GPA

Construct	<i>N</i>	<i>k</i>	<i>r</i> _{obs}	<i>SD</i> _{obs}	<i>r</i> _{op}	<i>SD</i> _{op}	ρ	<i>SD</i> _{ρ}	Lower 90%	Upper 90%
Aggregate measures	18,517	107	.33	.13	.37	.12	.41	.13	.17	.57
Study skills	24,547	87	.25	.18	.28	.18	.33	.22	-.02	.58
Study habits	23,390	102	.23	.15	.25	.15	.28	.16	.00	.50
Study attitudes	7,211	37	.26	.11	.28	.09	.31	.10	.13	.43
Study motivation	6,157	25	.23	.13	.25	.13	.30	.15	.04	.46
Study anxiety	3,943	22	-.17	.12	-.19	.10	-.21	.12	-.41	-.01
Deep approach	4,238	28	.12	.18	.13	.17	.16	.21	-.15	.41
Surface approach	6,224	32	.01	.15	.01	.14	.01	.17	-.22	.24
Achievement approach	4,184	27	.03	.18	.03	.18	.04	.21	-.27	.33
Metacognition	1,915	7	.18	.15	.19	.15	.22	.17	-.06	.44

Note. SHSA = Survey of Study Habits and Attitudes; *k* = number of studies; *r*_{obs} = sample size weighted mean observed correlation; *SD*_{obs} = observed standard deviation; *r*_{op} = operational validity; *SD*_{op} = standard deviation of operational validity; ρ = true score correlation; *SD* _{ρ} = standard deviation of true score correlation; lower 90% = lower bound of 90% credibility interval based on operational validity; upper 90% = upper bound of 90% credibility interval based on operational validity.

TABLE 12

Meta-Analyses for the Relationships Between the 10 SHSA Constructs and Performance in Individual Classes

Construct	<i>N</i>	<i>k</i>	<i>r</i> _{obs}	<i>SD</i> _{obs}	<i>r</i> _{op}	<i>SD</i> _{op}	ρ	<i>SD</i> _{ρ}	Lower 90%	Upper 90%
Aggregate measures	1,655	13	.18	.10	.20	.05	.22	.06	.12	.28
Study skills	2,175	21	.10	.20	.11	.18	.12	.22	-.19	.41
Study habits	3,628	34	.18	.20	.18	.17	.20	.19	-.10	.46
Study attitudes	1,855	19	.15	.12	.15	.06	.16	.07	.05	.25
Study motivation	2,158	11	.17	.14	.17	.12	.20	.15	-.03	.37
Study anxiety	704	8	-.09	.23	-.09	.20	-.11	.23	-.42	.24
Deep approach	3,025	21	.15	.20	.15	.05	.18	.06	.07	.23
Surface approach	2,134	17	-.04	.13	-.04	.09	-.05	.12	-.19	.11
Achievement approach	1,608	10	.02	.15	.02	.12	.02	.14	-.18	.22
Metacognition	1,978	9	.08	.17	.08	.16	.09	.17	-.18	.34

Note. SHSA = Survey of Study Habits and Attitudes; *k* = number of studies; *r*_{obs} = sample size weighted mean observed correlation; *SD*_{obs} = observed standard deviation; *r*_{op} = operational validity; *SD*_{op} = standard deviation of operational validity; ρ = true score correlation; *SD* _{ρ} = standard deviation of true score correlation; lower 90% = lower bound of 90% credibility interval based on operational validity; upper 90% = upper bound of 90% credibility interval based on operational validity.

recting our estimates for unreliability. Only sample-size weighted correlations are therefore presented. Study attitudes exhibited relatively strong relationships with neuroticism (*r*_{obs} = -.40), openness (*r*_{obs} = .30), conscientiousness (*r*_{obs} = .30), an external locus of control (*r*_{obs} = -.28), and achievement motivation (*r*_{obs} = .20). The relationship of personality constructs with study habits was generally weaker, with the strongest relationships being found for achievement motivation (*r*_{obs} = .35), conscientiousness (*r*_{obs} = .29), and self-concept (*r*_{obs} = .21).

DISCUSSION

The results provided in this article have a number of important practical and theoretical implications for the admissions process and educational psychology. The most immediate practical implication is that certain SHSA constructs need to be given a

larger role in admissions decision. They arguably represent the largest increase in predictive power observed in the literature beyond the mainstays of test scores and prior grades. Stated differently, aspects of SHSAs best explain why some succeed despite predictions of failure and why some fail despite predictions of success. Our greatest challenge as a field will be finding ways to assess these characteristics in high stakes operational settings.

On a theoretical level, our results offer broad support for our model of how individual difference factors affect academic performance in college more so than other noncognitive constructs. Support for the model is manifest in three ways. First, we have illustrated that many of the examined SHSA constructs are strongly related to academic performance. Study skills, study attitudes, study habits, and study motivation exhibited particularly strong and robust relationships with academic performance in college. Second, we were able to illustrate that,

TABLE 13

Relationship of SHSA Constructs and Their Incremental Validity Over High School GPA

Construct	<i>N</i>	<i>k</i>	<i>r</i> _{obs}	<i>SD</i> _{obs}	<i>r</i> _{op}	<i>SD</i> _{op}	ρ	<i>SD</i> _{ρ}	Lower 90%	Upper 90%	ΔR	ΔR^2
Aggregate measures	2,230	6	.20	.06	.20	.04	.22	.04	.13	.27	.09	.08
Study skills	3,916	10	.10	.19	.10	.18	.12	.21	-.20	.40	.07	.06
Study habits	3,126	6	.13	.09	.13	.08	.14	.10	.00	.26	.04	.03
Study attitudes	494	5	.00	.12	.00	.06	.01	.06	-.10	.10	.09	.08
Study motivation	1,819	4	.14	.05	.14	.02	.16	.02	.11	.17	.09	.08
Study anxiety	169	2	.04	.06	.04	.02	.05	.00	.01	.07	.02	.02
Deep approach	—	—	—	—	—	—	—	—	—	—	—	—
Surface approach	—	—	—	—	—	—	—	—	—	—	—	—
Achievement approach	169	2	-.12	.04	-.12	.00	-.14	.00	-.12	.12	.01	.01
Metacognition	—	—	—	—	—	—	—	—	—	—	—	—
Time spent studying	2,369	3	.26	.12	.26	.11	.26	.11	.08	.44	.02	.02

Note. Incremental validity is calculated using the operational validity coefficients. SHSA = Survey of Study Habits and Attitudes; *k* = number of studies; *r*_{obs} = sample size weighted mean observed correlation; *SD*_{obs} = observed standard deviation; *r*_{op} = operational validity; *SD*_{op} = standard deviation of operational validity; ρ = true score correlation; *SD* _{ρ} = standard deviation of true score correlation; lower 90% = lower bound of 90% credibility interval based on operational validity; upper 90% = upper bound of 90% credibility interval based on operational validity.

TABLE 14

Relationship of SHSA Constructs and Their Incremental Validity Over College Admission Tests

Construct	<i>N</i>	<i>k</i>	r_{obs}	SD_{obs}	r_{op}	SD_{op}	ρ	SD_{ρ}	Lower 90%	Upper 90%	ΔR	ΔR^2
Aggregate measures	7,422	25	.17	.11	.17	.09	.18	.10	.02	.32	.11	.09
Study skills	6,297	21	.23	.26	.23	.25	.27	.30	-.18	.64	.06	.05
Study habits	7,713	31	.06	.11	.06	.10	.06	.10	-.10	.23	.06	.05
Study attitudes	7,016	36	.12	.07	.12	.04	.13	.05	.05	.19	.08	.06
Study motivation	2,168	7	.07	.06	.07	.03	.08	.03	.02	.12	.12	.10
Study anxiety	344	4	.04	.27	.04	.24	.04	.28	-.35	.44	.06	.05
Deep approach	1,054	5	.07	.05	.07	.00	.09	.00	.07	.07	.02	.01
Surface approach	852	4	.08	.15	.08	.13	.09	.16	-.13	.29	.00	.00
Achievement approach	1,025	6	.13	.08	.13	.03	.15	.03	.08	.18	.00	.00
Metacognition	408	2	.58	.08	.25	.05	.28	.05	.17	.33	.02	.01
Time spent studying	2,394	5	-.02	.08	-.02	.06	-.02	.06	-.12	.08	.06	.05

Note. Incremental validity is calculated using the operational validity coefficients. SHSA = Survey of Study Habits and Attitudes; *k* = number of studies; r_{obs} = sample size weighted mean observed correlation; SD_{obs} = observed standard deviation; r_{op} = operational validity; SD_{op} = standard deviation of operational validity; ρ = true score correlation; SD_{ρ} = standard deviation of true score correlation; lower 90% = lower bound of 90% credibility interval based on operational validity; upper 90% = upper bound of 90% credibility interval based on operational validity.

with the exception of study skills, SHSA constructs are only weakly related to measures of general cognitive ability and to prior performance in high school. This finding not only suggests that the acquisition of sound SHSAs is not dependent on high cognitive ability, but that SHSA scores explain a large amount of variance in academic performance in college above the variance accounted for by traditional predictors such as admissions test scores and academic performance in high school.

Third, we were able to illustrate that study attitudes and study habits are partially influenced by students' personality traits. Personality constructs such as conscientiousness, neuroticism, achievement motivation, and external locus of control exhibited meaningful relationships with study attitudes and/or study habits. These observed relationships are in line with findings that have linked personality traits to desirable habits and attitudes in other domains including health habits (e.g., Bogg & Roberts, 2004; Roberts, Kuncel, Shiner, Caspi, & Goldberg, 2007; Schneider & Busch, 1998) and

work habits (Barrick, Mount, & Strauss, 1993; Mount, Witt, & Barrick, 2000).

We were unable to test all aspects of our individual differences model of academic performance due to a lack of available evidence in the literature, but these three findings are supportive of important components of the overall model. The high validities of SHSA constructs, comparable with those of admissions tests such as the SAT, suggest that SHSA constructs can indeed be positioned as direct determinants of the acquisition of declarative and procedural knowledge in a college setting. Our findings regarding the relationship between personality and study attitudes and study habits suggests that the effect of certain personality traits on academic performance may be partially mediated through better study attitudes and study habits, as indicated by our model. The moderate strength of the relationships between personality and both study habits and study habits coupled with the lack of a relationship between study habits and attitudes and cognitive ability does, however, suggest to us that our model does not fully

TABLE 15

Meta-Analytic Correlations Between SSHA Subscales and Scores on Cognitive Admissions Tests

SSHA subscale	<i>N</i>	<i>k</i>	r_{obs}	SD_{obs}	r_{op}	SD_{op}	ρ	SD_{ρ}	Lower 90%	Upper 90%	ΔR	ΔR^2
Delay avoidance	3,662	14	.00	.09	.00	.06	.00	.07	-.15	.15	.10	.09
Work methods	3,662	14	.24	.11	.24	.09	.28	.10	.06	.42	.16	.05
Study habits	3,662	14	.14	.10	.14	.08	.16	.09	-.02	.30	.09	.07
Teacher approval	3,662	14	.12	.07	.12	.04	.16	.05	.00	.24	.04	.03
Educational acceptance	3,662	14	.11	.08	.11	.05	.14	.07	-.02	.24	.11	.09
Study attitudes	3,662	14	.13	.08	.13	.06	.15	.07	.00	.26	.08	.06
Study orientation	6,710	23	.16	.11	.16	.10	.18	.11	-.02	.34	.09	.07

Note. Incremental *R* refers to the incremental *R* of each subscale over admissions test scores and is calculated using the operational validity coefficients for first-year GPA (or general GPA when coefficients are not available for first-year GPA). SHSA = Survey of Study Habits and Attitudes; *k* = number of studies; r_{obs} = sample size weighted mean observed correlation; SD_{obs} = observed standard deviation; r_{op} = operational validity; SD_{op} = standard deviation of operational validity; ρ = true score correlation; SD_{ρ} = standard deviation of true score correlation; lower 90% = lower bound of 90% credibility interval based on operational validity; upper 90% = upper bound of 90% credibility interval based on operational validity.

TABLE 16
Meta-Analytic Correlations Between Study Habits and Study Attitudes and Eight Personality Constructs

Construct	Study habits							Study attitudes						
	<i>N</i>	<i>k</i>	<i>r</i> _{obs}	<i>SD</i> _{obs}	<i>SD</i> _ρ	Lower 90%	Upper 90%	<i>N</i>	<i>k</i>	<i>r</i> _{obs}	<i>SD</i> _{obs}	<i>SD</i> _ρ	Lower 90%	Upper 90%
Achievement motivation	923	9	.35	.16	.13	.14	.57	465	4	.20	.09	.03	.15	.25
Neuroticism	1,152	9	-.11	.35	.34	-.67	.45	292	3	-.40	.11	.07	-.52	-.28
External locus of control	1,658	14	-.16	.19	.16	-.42	.10	1,026	7	-.28	.10	.06	-.38	-.18
Internal locus of control	610	6	-.06	.13	.13	-.30	.13	501	4	.03	.06	.00	.03	.03
Extroversion	1,429	6	-.11	.09	.06	-.21	-.01	881	3	-.14	.03	.00	-.14	-.14
Openness	1,020	4	.08	.08	.05	.00	.16	1,700	5	.30	.25	.12	.10	.50
Contentiousness	1,194	5	.29	.13	.11	.11	.47	891	4	.30	.05	.00	.30	.30
Self-concept	767	8	.21	.07	.00	.21	.21	372	5	.13	.06	.00	.13	.13

Note. *k* = number of studies; *r*_{obs} = sample size weighted mean observed correlation; *SD*_{obs} = observed standard deviation; *SD*_ρ = standard deviation of true score correlation; lower 90% = lower bound of 90% credibility interval based on operational validity; upper 90% = upper bound of 90% credibility interval based on operational validity.

account for the factors that determine the acquisition of sound study habits and study attitudes.

Our results also showed that general cognitive ability is moderately related to study skills ($\rho = .27$), which is in line with findings from the organizational literature that show that cognitive ability facilitates the acquisition of knowledge and skills (e.g., Hunter & Hunter, 1984). The effect of general cognitive ability on academic performance therefore appears to be partly mediated through the acquisition of good study skills, although a strong direct effect of cognitive ability on academic performance remains.

Our results also provide widely varying levels of support for the different theoretical approaches that have informed the manner in which SHSA constructs are conceptualized and assessed. Constructs such as study skills, study attitudes, study habits, and study motivation exhibited relatively strong relationships with academic performance. Validities for these four constructs for the freshman GPA criterion ranged from .27 for study habits to .39 for study motivation. Other constructs such as the deep, surface, and strategic approaches exhibited considerably lower validities. The general GPA criterion scores on both the surface approach ($\rho = .01$) and strategic approach ($\rho = .04$) exhibited no validity. The validity of the depth-of-processing theoretical perspective is therefore called into question.

Some additional practical implications and benefits are also evident. Our findings are likely to assist colleges and college counselors in identifying and assisting those students who are likely to struggle academically. Well-constructed SHSA inventories could easily be administered to incoming freshmen in order to identify students who may benefit from further training in effective study techniques. Not only do our results focus attention on the apparent need for college students to have sound study skills, habits, and attitudes, but our findings regarding the

validity of scores on different inventories are likely to assist in the process of choosing appropriate inventories when attempting to assess and diagnose learning difficulties in college students. Scores on some inventories, such as the LASSI (C.E. Weinstein & Palmer, 2002) and the SSHA (W.F. Brown & Holtzman, 1967), exhibited high validities across multiple samples and appear to be more useful in understanding the academic performance of college students than are other inventories such as the Study Process Questionnaire (e.g., Biggs et al., 2001) and the Study Attitudes and Methods Survey (e.g., W.S. Zimmerman et al., 1977). Tables 17 and 18 highlight the content of the subscales of the SSHA and LASSI, respectively.

Our findings also indicate a positive direction for changes in the factors that are considered in the college admissions process. The question is how to best integrate SHSA factors in the admissions process. Despite the high predictive validity of scores on inventories such as the SSHA and LASSI, we must caution against their use in high-stakes admissions contexts due to the vulnerability of self-report inventories to faking and socially desirable responding. The precise degree of this vulnerability to faking is not known, but it could easily be established by investigating the validity of scores on various inventories under applied conditions when completed by both self and objective others. Rather, we hope that these results may act as a spur for the development of psychometrically sound rating forms that could be used by high school teachers, principals, and counselors. Such ratings would reduce the impact of socially desirable response patterns and also allow SHSA information about college applicants to be used in an admissions context or be used to identify at-risk freshman college students who may benefit from counseling and other forms of academic assistance. If scores on these ratings forms were to illustrate validities in an applied selection context that are comparable

TABLE 17
Scale Descriptions and Sample Items of the Survey of Study Habits and Attitudes

Subscale	Content	Sample item
Delay avoidance	The degree to which the student is prompt in completing academic assignments.	I put off writing themes, reports, term papers, etc. until the last minute.
Work methods	The degree to which the student has an effective study procedure and efficiency in completing academic assignments.	I keep my place of study businesslike and cleared of unnecessary or distracting items such as pictures, letters, and mementos.
Study habits	Combination of delay avoidance and work methods that reflects the student's academic behavior.	
Teacher approval	The degree to which the student has a favorable opinion of teachers and their classroom behavior and methods.	My teachers succeed in making their subjects interesting and meaningful to me.
Educational acceptance	The degree to which the student approves of the objectives, practices, and requirements of the educational institution.	I feel that it is not worth the time, money, and effort that one must spend to get a college education.
Study attitudes	Combination of teacher approval and educational acceptance that reflects the student's academic attitude.	
Study orientation	Combination of study habits and study attitudes that reflects the student's study habits and study attitudes.	

with those of the inventories discussed in this article, then the utility of college admissions systems would likely witness substantive improvements (as indexed by the proportion of correct to incorrect admissions decisions).

One final notable finding is that SHSA constructs exhibit near-zero relationships with high school academic performance despite being strongly related to college academic performance. This finding may appear to be counterintuitive, as factors that

TABLE 18
Scale Descriptions and Sample Items of the Learning and Study Skills Inventory

Subscale	Content	Sample item
Attitude	Assesses the student's attitudes and interest in college and academic success.	I feel confused and undecided as to what my educational goals should be.
Motivation	Assesses the student's diligence, self-discipline, and willingness to exert the effort necessary to successfully complete academic requirements.	When work is difficult I either give up or study only the easy parts.
Time management	Assesses the student's application of time management principles to academic situations.	I only study when there is the pressure of a test.
Anxiety	Assesses the degree to which the student worries about school and their academic performance.	Worrying about doing poorly interferes with my concentration on tests.
Concentration	Assesses the student's ability to direct and maintain attention on academic tasks.	I find that during lectures I think of other things and do not really listen to what is being said.
Information processing	Assesses how well the student can use imagery, verbal elaboration, organization strategies, and reasoning skills as learning strategies to help build bridges between what they already know and what they are trying to learn and remember.	I translate what I am studying into my own words.
Selecting main ideas	Assesses the student's skill at identifying important information for further study from less important information and supporting details.	Often when studying I seem to get lost in details and can't see the forest for the trees.
Study aids	Assesses the student's use of supports or resources to help them learn or retain information.	I use special help, such as italics and headings that are in my textbook.
Self-testing	Assesses the student's use of reviewing and comprehension monitoring techniques to determine their level of understanding of the information learned.	I stop periodically while reading and mentally go over or review what was said.
Test strategies	Assesses the student's use of test preparation and test taking strategies.	In taking tests, writing themes, etc. I find I have misunderstood what is wanted and lose points because of it.

Note. Adapted from Weinstein & Palmer (2002).

are important in determining academic performance in one domain (college) should also be important in another domain (high school), but we identify three possible reasons for the lack of a relationship between SHSA constructs and HSGPA. First, SHSAs may be better predictors of college grades than of HSGPA because of substantive differences in the nature of academic performance in these two settings. The college academic environment is not only associated with an increased levels of both quantity and difficulty in academic assignments, but also with a lower level of academic structure and a subsequent increase in the amount of personal responsibility that students must exercise to meet these academic challenges (Larose, Bernier, & Tarabulsky, 2005). Effective study habits and study skills therefore gain in importance.

Second, colleges expend significant resources on classes and workshops intended to help new students acquire appropriate study skills and study attitudes, and many of these programs appear to be successful at improving students' study skills and study habits (see Hattie et al., 1996, for a review of these programs). Differences in these newly acquired skills and habits are likely to be reflected in students' future academic performance but not in their prior academic performance.

Third, students in each of the samples included in our meta-analyses were typically drawn from a single college, but they originally attended a wide variety of high schools. Differences in grading standards across these high schools would substantially attenuate the observed correlations between HSGPA and scores on SHSA measures within any individual sample of college students, as a HSGPA of, say, 3.0 in a school with substantial grade inflation would represent a significantly different level of educational attainment than would a HSGPA of 3.0 in a school with little or no grade inflation. These two students are likely to have substantially different levels of SHSAs. Such differences in grading standards across high schools and their attenuating effect on correlations of HSGPA with other variables such as socioeconomic status, SAT scores, and college grades have been well documented in the educational literature (e.g., Bassiri & Schultz, 2003; Rubin & Stroud, 1977; Willingham, Pollack, & Lewis, 2002; Zwick & Green, 2007). Bassiri and Schultz, for example, used ACT assessment test scores to adjust HSGPA for different grading standards and showed that HSPGA adjusted in this manner predicted freshman GPA significantly better than did unadjusted HSPGA.

LIMITATIONS AND FUTURE RESEARCH

This article has effectively summarized the available validity evidence for scores on both individual SHSA inventories and for SHSA constructs. However, due to a lack of available evidence, we have not been able to complete an examination of the relationship among inventories or constructs that would shed light on the discriminant validity of these 10 constructs. Most researchers in this field rely on individual inventories that do not

capture the full range of constructs discussed in this article, making it impossible to construct a meta-analytic construct intercorrelation matrix. For example, despite their widespread use in empirical investigations, we are aware of only one study (Cole, 1988) that has examined the relationship between the SSHA and LASSI. Until more such studies have been completed, the important issue of construct redundancy cannot be addressed.

The lack of available validity evidence furthermore did not allow us to estimate the strength of the relationships of SHSA constructs and inventories with other important college outcomes, such as persistence in college. We believe that the SHSA literature would benefit from greater attention to this relationship and to the relationship between SHSAs and various non-academic college outcomes such as adjustment, health behaviors, and stress. Our results also show that study habits and study attitudes are unrelated to cognitive ability and are only moderately related to certain personality constructs. Future research should attempt to establish what other factors might contribute to the development of effective study habits and attitudes.

Future research should also more closely examine the validity of scores on depth-of-processing inventories (e.g., Study Process Questionnaire) that we've shown to be largely invalid with regard to academic performance as assessed by GPA and grades in individual classes. It is possible that scores on these inventories may exhibit more substantive validities for other important academic outcomes (e.g., graduation, retention, time to degree completion), and we therefore do not recommend that these constructs and inventories be discarded. Rather, we recommend further psychometric development of these inventories and that researchers and college counselors may benefit from a greater reliance on those inventories (e.g., LASSI, SSHA) that appear to capture the most criterion-relevant variance until the validity of depth-of-processing inventories has been adequately illustrated. It is unfortunate to consider that although scores on the SSHA have the highest criterion-related validities of all the examined SHSA inventories, its use has declined considerably since it was first developed in the 1950s. Its place appears to have been taken by more recently developed inventories that were not constructed with the same psychometric care as the SSHA, and they appear to be considerably less useful in understanding college academic performance.

We have noted above that the consideration of SHSA information may lead to a substantial improvement in the accuracy of college admissions decisions. What is currently unknown is whether this increase in accuracy could also be accompanied by a reduction in adverse impact. Future research will need to establish the size of mean score differences between groups (e.g., men and women, White and Black students) in order to allow an estimation of adverse impact under admissions systems that consider SHSA information.

CONCLUSION

We have shown that study skills, study habits, study attitudes, and study motivation exhibit relationships with academic performance that are approximately as strong as the relationship between academic performance and the two most frequently used predictors of academic performance: prior academic performance and scores on admissions tests. This finding, together with the relative independence of SHSA constructs from both prior academic performance and admissions test scores, suggests that study skills, study habits, study attitudes, and study motivation play a critical and central role in determining students' academic performance.

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