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ABSTRACT

This study examined the predictive validity of precollege variables, such as high school rank, high school mathematics and science preparation, motivation, and self-regulated learning variables in predicting academic achievement status for high- and low-achieving university students using hierarchical logistic regression. The variables used were entered in sequential blocks based on theoretical backgrounds and precious research. The sample included 102 low-achieving students and 226 high-achieving students from a large research university. Survey research methods, with follow-up letters, and the universitys electronic database were used to gather information about the variables and student self-reports of self-regulated learning strategies and study skills. A new instrument, the Learning Strategies and Study Skills Survey, was developed for this study. Findings provide support for the overarching idea that multiple indicators should be used in predicting students academic achievement in college. Accumulated evidence, including findings from this study, indicates that in addition to acquiring knowledge, students should develop self-regulatory competence to achieve at high levels in challenging postsecondary education environments. (Contains 4 tables and 108 references.) (SLD)

Factors Impacting the Academic Status of Undergraduate Students at Four-Year Institutions

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Factors Impacting the Academic Status of Undergraduate Students at Four-Year Institutions

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Introduction

According to Travers (1999), the concern for academic preparedness for the world of work has become a focus at national and international levels (Sheckely, Lamdin, & Keeton, 1993; U.S. Department of Education, 1997). Recent evaluations of employability skills indicate that to solve the types of problems encountered in today's world and to remain competitive in professional settings, adults need the ability to effectively deal with issues involving different levels of cognitive complexity (Drucker, 1994; Sheckley et al., 1993; Travers, 1999). It is reasonable to assert that an important purpose of postsecondary education is that students develop more advanced and independent ways of learning (Vermetten et al., 1999). Research shows that advanced students demonstrate greater degree of self-regulated learning and higher levels of critical thinking in comparison with novices (Brown, Collins, & Duguid, 1989; Brown & Pressley, 1994). A number of studies (e.g., Schunk & Zimmerman, 1994; Bol, Warkentin, Nunnery, & O'Connell, 1999; Pintrich & DeGroot, 1990; Zimmerman & Martinez-Pons, 1986, 1988) indicated a strong link between students' use of self-regulated learning (SRL) strategies and their academic achievement and involvement in a course. In particular, research in educational settings (e.g., Borkowski & Thorpe, 1994; VanZile-Tamsen & Livingston, 1999) has demonstrated that a major difference between academic outcomes of low- and high-achieving students is the degree to which they self-regulate their learning.

According to Stouch (1993), the process of "learning how to learn" involves processing, or acquiring, the knowledge and skills to learn effectively in diverse learning situations. Arguably, adults are learners with diverse needs, and using the concept of learning how to learn is one way to acknowledge individual differences. In addition, motivation has emerged as a powerful explanatory variable distinguishing academically successful students from other students. Current research on self-regulation attempts to reach beyond academic settings. In particular, Zimmerman (1998a) reported anecdotal evidence that the types of self-regulated learning (SRL) strategies which students use in school settings (see, for example, Zimmerman & Martinez-Pons, 1986, 1988) are used in authentic settings by professionals in such diverse fields as sports, music, and professional writing, among the others. The ideas that there are some similarities in the way individuals self-regulate in both academic and professional settings provides an important link to the concept of life-long learning and the importance of academic self-regulatory behaviors.

Background of the Study

Academic Self-Regulation

According to Bandura (1997), one of the major advanced in the study of lifelong cognitive development relates to the mechanisms of self-regulated learning in academic settings. *Academic self-regulation* refers to the process in which students activate and sustain cognitions, behaviors, and affects that are systematically oriented toward the attainment of goals (Zimmerman, 1989; 1998a, 1998b). Self-regulated learners are generally characterized as active learners who efficiently and effectively manage their learning with respect to metacognitive, motivational, and behavioral aspects (Zimmerman, 1989). Zimmerman identified the hallmarks of academic self-regulation to include: academic time management, practice, mastery of learning methods, goal-directedness, and robust sense of self-efficacy. The construct of academic self-regulation has gained increasing attention in the last two decades, resulting in numerous studies conducted in a variety of settings with individuals representing different age and achievement groups (Pintrich & De Groot, 1990; Pintrich & Schunk, 1996; Schunk & Zimmerman, 1994; Zimmerman & Martinez-Pons, 1986, 1988, 1990). Self-regulated learning is an important component for the academic success of college students. In contrast to K-12 students, most college students have a great deal of control over their own time management and schoolwork schedules as well as over how they structure their studying and learning activities (Pintrich, 1995).

In a review of research on underachievement, Borkowski and Thorpe (1994) pointed out that a well-developed set of skills that enable individuals to self-regulate their learning is a desirable outcome of academic and career success across the life-span of any individual. They further conclude that a lifetime of deficient self-regulatory skills leaves adults lacking the ability to manage the complex issues occurring in today's world (e.g., insufficient funds, changing employability skills, etc.). Failure of adequate self-regulation has also been linked to many of the major problems of our contemporary society, such as: lack of control over personal behaviors, child abuse, addictions, and obsessions (Baumeister, Hetherton, & Tice, 1994). Many researchers have argued about the importance of self-regulated learning for students at all academic levels. According to Pintrich (1995), this construct "offers an optimistic perspective on college learning and teaching" (p. 11). Pintrich characterized this perspective as including several assumptions about learning and teaching that have important implications for students and faculty, such as: students can learn to be self-regulated given sufficient motivation; self-regulation is a controllable process; self-regulated learning (SRL) is critically important for the college context; and SRL is teachable.

Self-Regulated Learning Strategies and Academic Achievement

Even though there is substantial research on operationalizing and measuring academic self-regulation, differences in views on the construct among researchers may have implications for interventions with disabled and non-disabled student populations. According to Zimmerman and Paulsen (1995), some investigators treat self-regulation as an idiosyncratic set of skills that students use in their academic work. In particular, Crux (1991) explained that each student with learning disabilities (LD) must develop compensatory skills personally as he or she goes through school. Other investigators assume that a common set of standard self-regulatory learning skills exists and is used by the general population of students (Pintrich & Garcia, 1991; Zimmerman, 1989). Both groups of researchers agree that these skills are highly predictive of student academic success, and that these skills can be taught. Existing instruments measure primarily standard self-regulated learning strategies used by secondary and postsecondary students (e.g., Pintrich, Smith, Garcia, & McKeachie, 1993; Weinstein, Zimmerman, & Palmer, 1988; Zimmerman & Martinez-Pons, 1986, 1988).

A major component of academic self-regulation is self-regulated learning strategies defined by Zimmerman (1989) as "actions and processes directed at acquiring information or skills that involve agency, purpose, and instrumentality perceptions by the learners" (p. 329). Zimmerman and Martinez-Pons (1986), using interviews with high school students, found evidence of 14 types of self-regulated learning strategies including such methods as organizing and transforming information, self-consequating, seeking information, and rehearsing and using memory aids. Students' use of these strategies was highly correlated with their achievement and with teachers' ratings of their self-regulation in a class setting. In fact, students' reports of their use of these self-regulated learning strategies predicted their achievement track in school with 93% accuracy, and 13 of the 14 strategies discriminated significantly between students from the upper achievement track and students from lower tracks. The self-regulated learning strategies described by Zimmerman (1989) encompass three classes of strategies that all students use to improve self-regulation of their (a) personal functioning; (b) academic behavioral performance; and (c) learning environment (Bandura, 1986; Zimmerman, 1989).

Motivation and Academic Self-Regulation

Students' Regulation of Their Motivation. In addition to monitoring and controlling cognitive and metacognitive strategies, self-regulated learners also actively manage other important aspects of their classroom learning (Wolters, 1998). In particular, according to the social cognitive theory of academic self-regulation, students regulate the motivational, affective, and social determinants of

their intellectual functioning as well as the cognitive aspects (Zimmerman, 1986; 1990; Zimmerman & Bandura, 1994). In fact, Bandura (1997) contended that the cognitive aspects of self-regulated learning cannot be viewed separately from the motivational aspects. For example, a student may have adaptive cognitive and metacognitive skills, but they will exert little influence on academic performance if he or she fails to use them. As a consequence, motivation, characterized as a student's willingness or desire to be engaged and commit effort to completing a task, is an important component of classroom learning that students may choose to self-regulate (Wolters, 1998). Pintrich and Schrauben (1992) explained that in behavioral terms, motivation is indicated by a student's choice to engage in a particular activity and the intensity of his or her effort and persistence for that activity. As a consequence, self-regulated students are generally regarded as highly motivated students because they exhibit greater levels of engagement, effort and persistence for learning tasks than their peers who do not self-regulate (Zimmerman, 1989, 1990).

Motivation in Using Self-Regulated Learning Strategies as a Function of their Utility. Utility in the context of this investigation encompassed several issues. First, personal utility refers to students' personal and informal assessment of the usefulness of a particular learning strategy or method in their own academic work. Simply put, if students do not find ways to internalize a particular learning strategy and apply it consistently in their courses, they will not use it (Garner, 1990; Nolen & Flaladyna, 1990). Another aspect of the utility of learning strategies relates to the generalizability of these strategies across settings. It appears that certain kinds of learning strategies may be useful in school settings, but may have limited generalizability beyond academic settings. For example, the use of routine memorization may help some students get good grades in certain courses, but it may turn out to be of limited practical utility to them in professional or authentic settings that may place more emphasis on creative and critical thinking abilities, and problem solving (see, for example, Zimmerman, 1998a, 1998b).

Motivation as a Function of Students' Level of Academic Dedication. Lahmers and Zulauf (2000) argued that academic involvement has a positive relationship with college students' GPA. They cited Astin (1984) who suggested that academic involvement has both quantitative and qualitative characteristics. A quantitative measure of academic involvement, or a proxy for student effort expenditure, concerns the amount of studying, or the number of hours that students spend on their academic work in class and outside of class. Arguably, such quantitative measures also reflect the interest of students in academics, because greater interest in and dedication to scholastic work should result in a greater amount of time students may choose to spend on academics, despite other competing alternatives in the environment (Bandura, 1997; Zimmerman & Bandura, 1994). Zulauf

and Lahmers (2000) cited several studies that provided evidence of the relationship between academic time use and college students' academic achievement. Among recent studies conducted with college students in a variety of majors and courses, contradictory results emerged concerning the relationship between time spent on academic pursuits and student academic achievement or their course grades, with several studies reporting a significant positive relationship (e.g., Di, 1996; Miethe, 1989), and other studies finding either a very small relatioship (e.g., Lahmers & Zulauf, 2000) or no relationship (e.g., Kember, Jamieson, Pomfret, & Wong, 1995). Lahmers and Zulauf (2000), along with other researchers, suggested that including a measure of time management ability would help clarify these contradictory results. In a study of 470 university students, Ruban (2000) found that academic dedication (i.e., the number of hours spent studying outside of class time) provided an incremental validity of 1% hierarchical regression analysis, above and beyond the variance explained in students' GPA by the collection of demographic and academic variables (i.e., gender and academic level in college) and students' self-reported use of self-regulated learning strategies. In addition, several studies examined the relationship between study time and GPA as a function of students' academic level. Michaels and Miethe (1989) found that the amount of time spent on academics was associated with higher grades for lower academic division students (i.e., freshman and sophomores), but had little impact on the academic achievement for juniors and seniors. Ereckson (1992) reported that freshman students earn a significantly lower GPA than students of other academic levels. Given previous findings, it is reasonable to assert that the relationship between amount of study time and academic achievement should be studied within the framework of self-regulated learning.

Research on Self-Regulated Learning Among Low- and High-Achieving Students

Zimmerman and Martinez-Pons (1986, 1988) measured the degree to which high school students used the self-regulated learning strategies across different contexts, such as doing assignments in the classroom, preparing assignments at home, preparing for tests, and when poorly motivated. Some of the major findings were that high achieving students use self-regulated learning strategies more often and more efficiently than do low achieving students. According to Bandura (1997), by managing their own learning, effective self-regulators attain at higher academic levels than poor self-regulators.

High Achieving Students. Researchers have found that differences in the use of study and learning strategies exist among low and high achieving students. High achieving students actively develop, modify, and transfer strategies to new contexts, and employ more effective and efficient

strategies than low achieving do (Dai et al., 1998; Zimmerman & Martinez-Pons, 1990). These students are more goal oriented, and have higher self-efficacy for learning and for self-regulated learning strategies (Schunk, 1989, 1990, 1991). In his review of literature on high achieving students' self-regulation and motivation, Schunk (1998) noted that gifted children hold higher perceptions of their capabilities relative to their peers (e.g., Dai, Moon, & Feldhusen, 1998; Pajares, 1996b). With respect to motivational measures, gifted children outperform their nongifted counterparts on measures of intrinsic motivation, challenge seeking, and persistence (Dai et al., 1998). In sum, studies comparing gifted with nongifted students generally have shown that gifted students demonstrate a greater repertoire of self-regulatory processes and employ them with greater consistency and frequency (Schunk, 1998).

Low Achieving Students. Krouse and Krouse (1981) provided evidence that that a major cause of underachievement is the inability of students to use self-control strategies effectively. It is reasonable to assume that many students on academic probation in colleges and universities are students who lack self-regulation. Several researchers compared low achievers and underachievers, and found parallels between these two groups on several parameters relating to self-regulated learning behaviors. For example, in their comprehensive review of literature on underachievement in gifted students, Reis and McCoach (2000) described underachievers as engaging in the following maladaptive behaviors: lack goal directed behavior; fail to set realistic goals for themselves (Emerick, 1992; Weiner, 1986); display poor coping skills; develop coping mechanisms that successfully reduce short-term stress, but inhibit long-term success (Gallagher, 1996). Reis and McCoach (2000) cited findings from other studies indicating that gifted underachievers possess poor self-regulation strategies; exhibit low tolerance for frustration; lack perseverance; and lack self-control (Baum, Renzulli, & Hebert, 1995; Diaz, 1998). In addition, Borkowski and Thorpe (1994) reviewed a body of research indicating that underachievers are more anxious (Sepie & Keeling, 1978) and are less self-efficacious about their performance (Claes & Salame, 1975), and that they set lower academic goals and lack persistence (Covington, 1992; Schunk, 1989; Yu, 1996). According to Zimmerman (1998b), these self-regulatory deficiencies have negative causal effects on underachievers' personality and emotional development, as well as their academic attainment.

Differential Impact of Motivation on the Self-Regulated Strategy Use for Low- and High-Achieving Students. In their study on college students, VanZile-Tamsen and Livingston (1999) found that motivation is differentially related to strategy use of high and low achievers. They utilized the integrated construct of *Positive Motivational Orientation* (PMO), which involves the individuals' beliefs about self-efficacy for learning, the amount of control they have over learning outcomes and

the importance of effort, the relevance of the value of that task, and their achievement goals in the learning situation. Major conclusions were that, in addition to appropriate instruction and practice in the use of cognitive and metacognitive self-regulation strategies, students also need *motivation.* For example, in their study lower achieving students reported less self-regulated strategy use than their higher achieving peers. In addition, self-regulated strategy use was more strongly related to a positive motivational orientation for lower achieving students. These findings may have important implications for designing interventions. As VanZile-Tamsen and Livingston (1999) explained, if these motivational factors are predictive of self-regulated strategy use for high achievers but not for low achievers, then attempting to enhance motivation as a way to increase strategy use, and thus, achievement, will only increase the achievement gap because it will foster strategy use in high achievers only. On the other hand, if motivation is equally important for both low and high achievers, then enhancing motivation should result in eventual achievement gains for both groups. These findings should to be interpreted with caution, as they were based on correlational research. Therefore, there is an increased need for researchers to utilize sophisticated designs, such as structural equation modeling (SEM), in order to model interrelationships in complex phenomena (Kenny, Kashy, & Bolger, 1998; Kline, 1998).

High School Mathematics and Science Preparation and College Participation

Accumulated research evidence links the type and extent of student academic preparation to college mathematics and science participation and achievement (Nora and Rendon, 1990; Updegraff, Eccles, Barber, & O'Brien, 1996). Nora and Rendon(1990) asserted that students in high school academic programs, compared to those in general and vocational programs, are more likely to study engineering or biological science. Similarly, students who concentrate on mathematics and science majors take more courses in those disciplines and tend to earn higher overall grades than nonparticipants (Malcom, 1983; National Science Foundation, 1994; West, 1985). In general, lower achieving students tend to avoid taking mathematics and science courses, in which academically oriented students tend to enroll, and select themselves out of higher-level courses. As a consequence, limited math and science exposure decreases their mathematics and science achievement and curtails their opportunities in college (Davis, 1986; Ethington & Wolfe, 1986; West, 1985). Nora and Rendon (1990) found that in their study, white females with little or adequate preparation received the lowest grades, had taken the fewest number of science courses in high school, and received the least amount of encouragement from significant others to attend college. Extensive evidence

documented underrepresentation of females in advanced math courses, which, in turn, effectively blocks doors to math-related occupations and college majors (Fennema & Sherman, 1978).

Recent reports have extended the concern more broadly to both males and females (NSF, 1994), with several reports of the educational status of American students pointing to fairly low levels of math proficiency in school settings (National Excellence Report, 1994). Some researchers (e.g., see Matthews, 2000) link student exposure to challenging high school classes in mathematics and science with the acquisition of valuable self-regulatory skills by school students, which become critically important for their subsequent academic careers. In particular, researcher Clifford Adelman, in his study "*Answers in the Tool Box*," examined academic records of a large cohort of 13,000 students who were followed from the tenth grade in 1980 until they were about 30 in 1993. It showed that despite the emphasis college admissions officers place on high school grades, scores and class rank, the strongest predictors of college completion were challenging classes. What mattered was how rigorous and challenging students' high school courses were, no matter what grades they received. Notably, these classes were the most important factor in predicting the success of minority students. Adelman explained that courses like Advanced Placement (AP) and International Baccalaureate (IB) help develop "self-directed learning skills," which have a positive relationship with adaptive outcomes in academic settings.

Traditional Prediction of College Achievement Using Standardized Tests

Prediction of academic achievement has been a pervasive topic in American education. Proliferation of research studies conducted within this paradigm have proposed a large number of variables which can potentially explain academic achievement in K-12 and postsecondary settings. Particularly, a general proclivity for using various standardized measures has resulted in overreliance on the SAT and the ACT standardized scores in predicting academic attainment in college (e.g., Wilson, 1983). Naumann (1998) pointed out that the validity of academic assessment inevitably becomes an essential issue when educational measures are used in "high stakes" test environments where the decision-making process may have a long-term impact on an individual's life. For instance, the results of such tests have serious implications for persons trying to secure a particular job, qualify for certain educational programs or attain admittance into college. She contended that it is unreasonable for measurement specialists or college admission personnel to be satisfied with a scale that is able to predict only 15-20% of the variance in college performance. The researcher cited several studies that examined the amount of variance in academic performance that these tests are able to explain. For example, the average amount of variance in the first-year grade-point average

explained by the SAT or the ACT is only 25%, with most studies reporting values slightly above 10% (Linn, 1990). These values remain fairly stable when cumulative grade point average after four year of college is used as a criterion variable (Wilson, 1983). In contrast, these values decrease dramatically when high school grade point average or class ranks are added into the prediction equation (Neisser et al., 1996).

In addition, using a large sample of college students, Barron and Norman (1992) found that the SAT scores were able to provide extremely small incremental validity, adding only about 4% increase [i.e., small effect size according to Cohen's (1988) guidelines] in the prediction of the variance in the cumulative GPA after four years of college above and beyond the amount predicted by high school grade point average. Crouse and Trusheim (1988) supported these findings, providing evidence that high school grade point average may be a better predictor of college GPA, and that the SAT does not provide significant incremental validity to the prediction, after controlling for the effects of high school rank. Furthermore, research conducted within the social cognitive theory framework questions the predictive power of standardized aptitude measures in predicting college attainment. For example, Zimmerman and Bandura (1994) examined the impact of self-regulatory influences on writing course attainment in a selective postsecondary institution. They found that students' verbal aptitude (i.e., SAT-Verbal scores) did not have any direct impact on course grades when self-regulatory factors were included. Verbal aptitude affected writing course outcomes only indirectly by its influence on self-evaluative standards and personal goal setting. Importantly, the self-regulatory factors in the path model not only mediated the influence of verbal aptitude but also provided an incremental contribution of 29% in the prediction of the final grades in the writing course.

This study examined the predictive validity of pre-college variables, such as high school rank, high school math and science preparation, motivation, and self-regulated learning variables in predicting and academic achievement status for university students (i.e., low- versus high-achieving students) using hierarchical logistic regression analyses. The variables used in the analyses were entered in sequential blocks based on theoretical backgrounds and previous research. The following research question was examined in this study:

What is the predictive power of the following sets of variables in differentiating low- and hi-achieving university students: demographic factors (i.e., gender), pre-college factors (i.e., high school rank; math and science high school preparation), motivational factors (e.g., reasons for using self-regulated learning variables; perceived usefulness of the learning strategies; and academic

dedication), and self-regulated learning strategies (e.g., Conceptual Skills, Study Routines, Routine Memorization, Reading & Writing Metacognitive Strategies, Help Seeking, and Compensatory Supports)?

Methods and Procedures

Research Design

In this study survey research methods were utilized. Survey research design, a form of descriptive research, provided an overarching framework for this investigation, which was conducted in a higher educational sett... (Light, Singer, & Willett, 1990). Survey research methods were used to gather data about demographic characteristics, study practices, and student self-reported use of self-regulated learning strategies and study skills among university students. The university electronic database was used to gather data about SAT scores and high school math and science preparation.

Sample

The sample in this survey research study included two groups of undergraduate students from a large research university in the northeast (N=328), low achieving students (n=102) and high achieving students (n=226). The demographic and academic characteristics of the sample are presented in greater detail in Table 1.

Low Achieving Students. The first group was initially comprised of 238 students who participated in a university program for students who are at-risk academically, in the fall of 1999 and spring of 2000. This is a voluntary intervention program designed to help students become academically successful. These students were placed on academic probation because they had failed to meet the University's minimum academic standards during the semester prior to enrollment in this program. Two consecutive waves of mailed surveys resulted in a total of 102 surveys, or a 51% rate. Of the 102 students who returned the surveys, 54.9% were female, with an average age of 20 years old. Two-thirds of the students were Caucasian (66.7%) and most of them were from the lower academic division (freshman, 33.3%; sophomore, 49.0%; juniors, 14.7%; and seniors, 2.9%). Students' self-reported cumulative GPA ranged from an extremely low of .42 to a high of 4.00 (M = 3.03; SD = .83). Their average high school rank was 68.04, with a standard deviation of 16.03.

High Achieving Students. A random sample of 300 students was drawn from all 838 students who participated in a university program for honors scholars in the 1999-2000 academic year. This program enables intellectually gifted and highly motivated students to receive a challenging and

rewarding university experience. All undergraduate students are eligible to participate, however, the admission standards are rigorous. Students need at least a 3.2 grade point average to be considered for the program, they must be in the top 8% of their graduating high school class and have generally scored a minimum of 1320 on the SAT's to be considered for the Honors Program. The majority of the sample were female students (72.4%); the mean age of this group was 20 years old. The plurality of respondents were white (79.6%), and they tended represented a variety of academic levels (freshman, 26.5%; sophomores, 31.0%; juniors, 24.8%; 24.8%). Their self-reported GPA ranged 3.20 – 4.00 (M = 3.62; SD = .33). Their mean high school rank was 94.84, with a standard deviation of 5.23 (see Table 1).

<Insert Table 1>

Instrumentation

A new 58-item instrument entitled *Learning Strategies and Study Skills Survey* (*LSSS,* Ruban & Reis, 1999) was developed for this study to assess students' self-reported use of self-regulated learning strategies and compensation strategies in their academic work across academic settings. This instrument was developed using Zimmerman's (Zimmerman, 1989; Zimmerman & Martinez-Pons, 1986, 1988) work on self-regulated learning strategies used by school students, and Reis, Neu, and McGuire's work on compensation strategies used by academically successful university students with learning disabilities (LD) (Reis et al., 2000; Reis, Neu, & McGuire, 1997). Alpha reliabilities on the six factors of the LSSS survey ranged from .70 to .92. The instrument utilized a five-point Likert summated ratings scale with only the end points labeled, from "1" = *"Not At All Typical of Me"* to "5" = *"Very Typical of Me."* Therefore, students' use of self-regulated learning strategies, as measured by the LSSS, is indicated along a continuum, as high scores indicate a more frequent use of learning strategies, and low scores suggest that a student generally does not use learning strategies in his or her academic work.

Data Analyses

Confirmatory factor analysis (CFA) and hierarchical logistic regression analysis were used to assess psychometric properties of the *LSSS* survey, and to classify students into low and high achieving, based on the theoretically grounded collection of demographic, academic, scholastic, motivational, and self-regulated learning variables. Data analyses were conducted using SPSS 10.1

for Windows (SPSS, 2001). Descriptive statistics were used on selected demographic and academic variables.

Confirmatory Factor Analysis. Support for the construct validity of the instrument was obtained through the use of a confirmatory factor analysis (CFA), which permits an examination of the psychometric adequacy of an instrument and can aid in item evaluation and construct development (Kenny, Kashy, & Bolger, 1998). The confirmatory factor analysis utilized a "model generation strategy" (McCallum, 1995) to improve fit to the data and achieve parsimony. The CFA analysis found sufficient support for the final measurement model. The final six-factor measurement model, consisting of 19 items, exhibited a significant chi-square, χ^2 (147) = 1080.63, $p < .001$. In confirmatory factor analysis, a non-significant value in the chi-square test supports the hypothesized model, however, the likelihood of rejecting a true model increases with the use of large sample sizes (Marsh, Balla, & McDonald, 1988). Therefore, the results were interpreted based on the following fit indices: Tucker-Lewis Index (TLI), Comparative Fit Index (CFI), and Root Mean Square Error of Approximation (RMSEA). The obtained results supported the existence of a six-factor structure on the LSSS survey (TLI = .90, CFI = .91, RMSEA = 0.037). The standardized loadings for the final measurement model were in the moderate to high range (.38 - .85), and all Cronbach alpha reliabilities were in the range recommended by Gable and Wolf (1993), i.e., .70 and above. The correlations among the factors ranged from non-significant to moderate (.02 to -.37). Table 2 presents students' mean scores on the self-regulated learning factors, Chronbach alpha reliabilities, and goodness of fit summary indices for the confirmatory factor analysis.

<Insert Table 2>

Logistic Regression Analysis. Logistic regression was used as the primary data analysis because of the dichotomous nature of the dependent or outcome variable. Students were classified as either high achieving (coded as 1) or low achieving (coded as 0). This statistical procedure was originally developed to examine the predictive nature of different factors on a specific dichotomous outcome in large databases. The ratio of cases-to-independent variables must be substantial for logistic regression; the rule of thumb offered by Tabachnick and Fidell (2000) is 50 cases for each predictor variable in the regression equation. A weighting process was utilized simply as a means of improving the power in the analysis by increasing the number of observations while not affecting the distributional properties of the variables in the study. However, no assumptions were made with

regard to how much the sample used in the study mirrored the population of high- and low-achieving students university-wide.

Logistic regression analysis for this study proceeded at three levels and included two types of inferential tests: tests of models and tests of individual predictors (Tabachnick & Fidell, 1996). The sequencing of variables was dictated by the pattern suggested in the literature. The estimation of alternative models for the logistic regression followed a hierarchical stepwise process whereby blocks of variables in the conceptual framework were added in a sequential manner. The validity of each added block of variables was assessed as to its contribution in explaining the criterion (high- vs. low-achieving) and improving the fit of the model (Cabrera, 1994). In each case, the two models were compared by computing the difference in the log-likelihoods. Differences in the degrees of freedom for each model were calculated in order to evaluate the chi-square (Tabachnick & Fidell, 2001). The utility of logistic regression rests on the maximum likelihood function, usually referred to as G^2 (or scale deviance). This statistic provided an overall indication of how well the estimate for the parameters in the model fit the data (Cabrera, 1994). The best fitting model was the one that yielded a significantly smaller G^2. The G^2 statistical test compared the differences in G^2 between two alternative models. Reduction in G^2 figures with an associated p-value of less than .05 indicated that the model accounted for a significant improvement of fit (Cabrera, 1994).

Procedure

Several data collection procedures were used in this study, in order to ensure the highest response rate and obtain accurate data. These strategies included mailed surveys, distribution of the surveys through the personnel working with the students in their respective programs (i.e., *The Honors Scholars Program* and *The Scholastic Probation Program*), distribution of surveys in class, direct phone calls and e-mail messages to students. A cover letter and a post-paid return envelope, when appropriate, were sent along with a questionnaire. Students were offered incentives to participate in the study, namely, (a) the respondents' names were entered in a random *drawing* of gift certificates from the campus bookstore; and (b) students who filled out surveys in class were given extra credit. Students were assured of anonymity and that only the investigator would have access to the data. Students' cumulative grade point average (GPA) obtained from the university electronic database was used as a measure of students' academic achievement in college.

Results

A hierarchical logistic regression analysis was performed to assess prediction of membership in one of the two categories of academic achievement for undergraduate students (low achieving and high achieving students), on the basis of theoretically grounded set of predictors that were entered in the following sequential blocks:

Block 1: Demographic (i.e., gender)

Block 2: Scholastic (i.e., high school rank)

Block 3: Math and Science High School Preparation (i.e., exposure to a high school calculus and physics course)

Block 4: Motivation for Using Self-Regulated Learning (i.e., perceived usefulness of self-regulated learning (SRL) strategies in one's academic work; global assessment of perceived benefits of the use of SRL strategies; and academic dedication, or amount of studying).

Block 5: Self-Regulated Learning (SRL) Strategies (i.e., learning strategies students use to help them become effective learners and succeed academically): Conceptual skills, study routines, routine memorization, reading and writing metacognitive strategies, compensatory supports, and help seeking.

Variables in the Hierarchical Logistic Regression Model

Gender in block 1 was dummy coded 0 (males) and 1 (females); high school rank in Block 2 was used as a continuous variable; calculus exposure and physics exposure in Block 3 were dummy coded 0 (no) and 1 (yes). Motivation for using self-regulated learning strategies in Block 4 was comprised of three variables: The first variable was measured by a composite variable comprised of ratings on seven dichotomized items, which asked students to indicate why they choose to use (1) or not to use (0) learning strategies and study skills in their academic work. The rationale for including this variable in the study was research indicating that students will be more motivated to use self-regulated learning strategies if they perceive that the strategies are useful in their academic work (Garner, 1990; Nolen & Flaladyna, 1990). The second variable was measured by a four-point Likert-type item, which asked students to rate the degree to which they consider the use of study skills and learning strategies to be beneficial in their work, from "1" = "*Not Beneficial,*" to "4" = "*Very Beneficial.*" Finally, academic dedication, or amount of studying, was represented by an ordinal variable indicating the number of hours per week students spend on academic assignment outside of class time, from 1 (0 – 4 hours) to 7 (over 30 hours). Self-regulated learning strategies in Block 5 were mean scale scores calculated for each of the six factors on the *LSSS* survey representing

students' self-reported use of SRL strategies in their academic work ("1" = "*Not At All Typical of Me*," to "5" = "*Very Typical of Me*."

Hierarchical Regression Model

Sixty-eight cases did not have usable values on the variable high school rank (i.e., they originally came from college preparatory or other types of private schools which do not rank their students). After deletion of these 68 cases, the overall sample size reduced from 328 to 260 students (72 low achieving students and 188 high achieving students). A weighting procedure that did not affect the distributional properties of the variables was used in the analysis to increase statistical power. Evaluation of adequacy of expected frequencies for categorical demographic predictors revealed no need to restrict model goodness-of-fit tests. Table 3 describes the measures used to assess the goodness of fit of the alternative models in the hierarchical regression model.

<Insert Table 3>

There was a good model fit (discrimination among the groups) on the basis of the entire collection of demographic, scholastic, motivational, and self-regulated learning variables, $G^2(443, N=260) = 232.079$ using a deviance criterion. Comparison of log-likelihood ratios (see Table 3) showed significant improvement with the addition of each predictor variable block. Overall classification was impressive. On the basis of the entire collection of demographic, scholastic, motivational, and self-regulated learning variables, correction classification rate for distinguishing between low- and high-achieving students was 96.5%.

Analysis of Individual Variables

The statistical significance of each variable in predicting the likelihood of being a high-achiever versus a low-achiever was determined by deriving logistic coefficient estimates and corresponding standard errors for each variable within a block found to be significant in the final model. To assist in comparing the contributions made by each variable, standardized regression weights were estimated for each variable. Odds ratios were used to assess the impact of each of the statistically significant variables on student achievement. Odds ratios were derived only for those parameters found significant in the final reduced model. Table 4 displays beta weights, standard errors, significance levels, and odds ratios for those variables found to be significant in each of the blocks.

Odds Ratios of Significant Variables in the Reduced Model

The results of the hierarchical logistic regression analysis indicated that the likelihood of being a high-achiever was influenced by seven significant factors. These factors were: student gender, the entering high school rank of students, enrollment in a Calculus course in high school, perceived benefits on the part of students with regard to the use of compensatory strategies, meanf1, and meanf6. Odds ratios were used to assess the likelihood of occurrence (high- versus low-achieving) impacted by each statistically significant variable in the regression equation (or model). An odds ratio greater than 1 indicates that the odds of being a high-achiever increase when a significant predictor variable increases; and an odds ratio of less than 1 indicates that the odds of being a low-achiever decrease when the independent variable increases (Menard, 1995). Results of the odds ratios for those individual variables found significant in each of the blocks are displayed in Table 4. The odds ratio (Exponential (B)) is presented not as a separate measure of the relationship between student achievement and the predictor variables in the model but as a different way of presenting the information.

<Insert Table 4>

The results revealed that female students were 5 times more likely to be high-achieving students. Being a male student indicated that the student was more likely to be low achieving at the end of the study period. Moreover, the higher the academic rank of the student as he or she graduated from high school positively influenced the chances of being a high achiever in college. For every unit increase in rank, the student was 1.2 times more likely to be a high-achieving student. A student with an academic rank of 80 was 2.4 times more likely to be a high achiever as compared to a student with an academic rank of 78. A student with an academic rank of 90 was 120 times more likely to achieve a higher level of performance as compared to a student with an academic rank of 80.

The largest impact on the likelihood of being successful in college academically was exerted by the enrollment of the student in a Calculus course during their high school years. Compared to those that did not enroll in that course, those students that were enrolled in Calculus were 28 times more likely to be a high-achiever in college. The second largest impact was brought to bear by the student's self-reported utilization of conceptual skills. For every unit increase in the engagement of conceptual skills, students were 16.6 times more likely to be high-achievers. As students utilized

more conceptualization strategies in their academic work, the higher the likelihood of achieving a high academic performance.

Another variable impacting on the academic success of undergraduates was the perceived benefits associated with the use of learning strategies. The more that students perceived a gain from the utilization of certain strategies, the higher the likelihood that the student would become a high-achiever. For every unit increase in the Likert scale measuring perceived benefits, students were 1.8 times more likely to achieve academic success. One impact that was somewhat puzzling was the use of routine memorization. Those students that reported less engagement in routine memorization were more likely to be low-achieving students. As the level of engagement in routine memorization decreased, each unit of decrease was associated with a 16% likelihood of being a low-achiever in college. As students became more engaged in the use of routine memorization, the higher the likelihood of succeeding academically. Finally, those students that sought help with regard to their academic work were 41% more likely to achieve success in their academic performance and considered high-achieving college students.

Demographic and Academic Differences Between Low- and High-Achieving Students

Low achieving ($n = 72$) and high achieving students ($n = 188$) as a group differed on several demographic, academic, motivational, and self-regulated learning characteristics (see Table 4). Experimentwise alpha was adjusted for multiple one-tail t-tests. Mean differences were in the predicted directions. High achievers had a significantly higher mean on conceptual skills [$t(326) = -9.948$, $p < .001$] and academic dedication, or amount of studying [$t(326) = -2.747$, $p < .001$], perceived benefits of using self-regulated learning strategies [$t(326) = -2.474$, $p < .001$], and high school rank [$t(326) = -5.551$, $p < .001$]. Low achievers had a significantly higher means on compensatory supports [$t(326) = 8.796$, $p < .001$] and help seeking [$t(326) = 2.928$, $p < .001$]. Using McNemar's test of differences between two independent proportions, it was found that higher significantly greater number of achievers took a Calculus course in high school (67.8% vs. 9.4%, correspondingly); and significantly greater number of achievers took a Physics course in high school (74.8% vs. 45.8%, correspondingly). (See Table 1)

Limitations

This section discusses the factors that limit the generalizability of the results in the present study. Broadly speaking, three major categories of limitations corresponded to the three sources of measurement error in survey research: (a) instrumentation; (b) respondents; and (c) data collection

techniques (Simsek & Veiga, 2000). In addition, some of the limitations related to the conceptualization of the research design and the theoretical framework of the study. First, students were asked to provide a self-report on their use of self-regulatory methods across academic contexts. It should be noted that students' self-report of their study behaviors in generic learning contexts may not reflect how they study for particular courses, and may also largely depend on the domain (King, 1992a, 1992b). Therefore, a scale that measures students' general academic practices may be a rough approximation of the way in which students use self-regulated learning in different courses (Bol, Warkentin, Nunnery, & O'Connell, 1999). Some researchers argue that students' self-regulated learning strategy use should be studied with reference to a specific subject matter and certain timeframe (e.g., Bol et al., 1999). Another issue relates to the nature of the self-report data, which do not reveal what the students report they do when asked to report their academic behaviors on the survey, and what they actually do in real academic contexts (Perry, 2002). With respect to respondents, there was a certain degree of heterogeneity and in our sample. The entire sample was comprised of students representing different achievement groups and disability status, i.e., low-, normal-, and high-achieving students and students with learning disabilities, with higher achievers comprising almost half of the sample. In addition, the low achieving group was mostly represented by males, and high achieving group was mostly comprised of females, which could pose threats of selection bias and limit the generalizability of the findings. Another issue relates to the availability of data for students' high school rank. Because 69 students did not have data on this variable, they were not included in the hierarchical logistic regression analysis. Overall, these limitations preclude generalizability of the study's findings to the general population of students at research universities.

Discussion and Conclusions

Much has been discussed concerning the role that standardized aptitude measures, gender, motivation and self-regulated learning play in the prediction of academic achievement of school and postsecondary students (e.g., Barron & Norman, 1992; Bouffard-Bouchard, Parent, & Larivee, 1993; Linn, 1990; Risemberg & Zimmerman, 1992; Schunk & Zimmerman, 1994; Royer, Tronsky, Chan, Jackson, & Marchant, 1996). Researchers have used these variables separately or in combination in prediction models using a variety of multivariate methods. Previous studies examined gender differences in standardized aptitude tests (Langenfeld, 1997; Royer et al., 1996), motivation, and self-regulated learning (Pintrich & De Groot, 1990; Pintrich & Scharauben, 1992; Wiener, 1986). Researchers also found differences on these variables among low achieving and high achieving

students (Ablard & Lipschultz, 1998; Dai et al., 1998; Bouffard et al., 1993; Risemberg & Zimmerman, 1990; Schunk, 1998; Yu, 1996). Several investigators pointed out that high school rank may be a better predictor of college academic achievement than standardized aptitude scores (e.g., Crouse & Trusheim, 1988); and others argued that the difference between more academically and less academically successful students enrolled in higher educational settings is a function of their high school mathematics and science preparation (see, for example, NSF, 1994; Nora & Rendon, 1990; Updegraph et al., 1996). The purpose of this study was to assess the utility and validity of the prediction model, which classified students into low achieving and high achieving on the basis of pre-college academic and scholastic variables, demographic, motivational and self-regulated learning variables. Variables were entered in sequential blocks based on theoretical grounds and previous research. The results of this study indicated that academic, motivational, and self-regulated learning variables contributed to the prediction of students' academic status above and beyond demographic variables (i.e., gender), as evidenced by a significant change in G^2 (scaled deviance) that was used to assess the contribution of each block and by the classification function of the model.

The importance of gender, as evidenced by a PCP of 68% (percent of cases correctly classified) may be attributed to several reasons. Previous research found that females get better grades in K-12 school settings (Fennema & Sherman, 1978; Kimball, 1989; Royer et al., 1996; Willingham & Cole, 1997) and in many postsecondary settings (Lahmers & Zulauf, 2000; Miller, Finley, & McKinley, 1990) but perform worse than males on standardized tests such as SAT and ACT (Bridgeman & Lewis, 1996; Langenfeld, 1997; Linn, 1990). However, the relationship of gender and academic achievement status may have been a function of the sample obtained for this study, or more specifically, selection bias in this study. Whereas the proportion of males and females for the low achieving group closely resembled the population proportions for the students participating in the scholastic probation program (55% vs. 45%), the proportion of girls and boys for the high achieving sample obtained for this study did not accurately represent the gender distribution in the Honors Scholars sample at the university where the data was collected. Almost three-fourths of the sample obtained for this study were female students, at a ratio of 3:1 between males and females (or 72% and 28%, correspondingly). This ratio was not quite consistent with the baseline information provided by the Honors program with 590 females and 248 males, corresponding approximately to a ratio of 2:1 between females and males. Therefore, the large effect of gender may have been partly attributed to the disproportionate number of high achieving females in the Honors Scholars sample.

Furthermore, a large body of research documented the importance of standardized aptitude and achievement measures, such as the SAT and ACT in predicting students' first year college GPA (e.g., Wilson, 1983). Barron and Norman (1992) found that the SAT scores were able to provide a very small incremental contribution of only 4% to the prediction of the variance in the cumulative GPA above and beyond the amount predicted by high school point average. Crouse and Trusheim (1988) contended that high school grade point average may serve as a better predictor of college academic achievement than standardized test scores. High school rank, which was used in this study as a proxy for students' academic aptitude, provided an incremental contribution of 68% to the classification validity of the model, which reflects on the importance of considering high school rank in making college admissions decisions.

Interestingly, the effect of enrollment in a high school Calculus course had the largest effect on the likelihood of being academically successful in college, whereas taking a Physics course did not improve the predictive validity of the model, as evidenced by the odds ratios in the model. In particular, compared to the students that did not enroll in that course, those students that were enrolled in Calculus were 28 times more likely to be a high achiever in college. An examination of the proportions of students who have taken a Calculus class in high school were 9.4% for low achievers and 67.8% for high achievers. The results of this study provide partial support for previous research findings linking the type and extent of student high school academic preparation in mathematics and science with their achievement outcomes in college (Nora & Rendon, 1990). Lower achieving students tend to select themselves out of challenging math and science courses in high school (NSF, 1994), which negatively impacts their academic preparation Davis, 1986; West, 1985), which, in turn, has a detrimental effect on their college enrollment opportunities and academic achievement (Ethington & Wolfe, 1986; NSF, 1994). Arguably, exposure to challenging high school math and science courses assists students in the acquisition of important self-regulatory and critical thinking skills, which are becoming increasingly important in today's world, as adults need the ability to deal with issues involving varying levels of cognitive complexity (Sheckley, Lamdin, & Keeton, 1993; Travers, 1998; U.S. Department of Education, 1997).

Of particular importance for the predictive validity of the model was a collection of variables measuring motivational and self-regulated learning strategies. Recent models of academic self-regulation have underscored the importance of students' use of cognitive strategies and regulation of their motivation for their academic attainment in college (e.g., Pintrich & DeGroot, 1990; Wolters, 1998; Zimmerman & Schunk, 1994; Zimmerman, 1989, 1998). Previous work in this area has shown that students who are more metacognitively aware of and who exert greater control of their learning

behaviors tend to have more adaptive educational outcomes (Butler & Winne, 1995; Pressley & McGormick, 1995; Schunk & Zimmerman, 1994; Zimmerman & Martinez-Pons, 1989).

In addition to monitoring and controlling the use of self-regulated learning strategies, self-directed learners also actively manage their motivation (Wolters, 1998). As Zimmerman and Bandura (1994) aptly noted, "it is one thing to possess self-regulatory skills but another thing to be able to get oneself to apply them persistently in the face of difficulties, stressors, or competing attractions" (p. 846). Several researchers (e.g., Garner, 1990; Nolen & Flaladyna, 1990) found that students'motivation for academic tasks was a function of their perceived utility and academic involvement in a course. In this study, three variables intended to represent a proxy for students' motivation: students' perceived usefulness of the use of self-regulated learning strategies, their global assessment of the derived benefit in using cognitive strategies, and their academic dedication, or self-reported amount of studying outside of class. In contrast to previous findings, students' appraisal of the utility of self-regulated learning strategies in their academic work and the self-reported amount of studying were not significant contributors to the model in the present study. Only students' global assessment of the perceived benefits accrued from using cognitive strategies was a significant predictor of academic status. Even though these findings seem counter-intuitive at first glance, there are several plausible explanations.

Even though low achievers' pattern of the use of SRL strategies was consistent with previous findings (i. e., they reported the largest number of the lowest means on the self-regulated learning factors as measured by the *LSSS* survey), some means for this group appeared counter-intuitive at first. For example, low achievers did not differ in their self-reported of study routine methods (i.e., time management and environment structuring) from high achievers. In addition, they reported a relatively high mean on academic dedication (i.e., 3.10, which corresponds to about 10-14 hours per week), compared to a mean of 3.60 the high achieving group. These findings could be attributed to the fact that the low achieving students who responded to the LSSS survey were actively utilizing the resources offered by the university program for students on scholastic probation, such as working with a facilitator or mentor who provides guidance with academic work. It appears that these respondents were motivated to improve their academic performance at the time of the administration of the survey (i.e., they are aware of their poor academic performance and they were trying to use some self-regulatory methods to improve their grades). Therefore, these findings may not reflect to the full extent the self-regulated learning pattern of college low achievers in general, who tend to study little and who do not use as many learning strategies and study skills as more academically successful students use (Borkowski & Thorpe, 1994; VanZile-Tamsen & Livingston, 1999).

In contrast to the low achieving group, the high achieving group reported the highest mean on conceptual skills and academic dedication, and the lowest means on compensatory supports and help seeking. Compensatory supports primarily referred to using technology supports such as using tape recorders in class to supplement class notes, listening to textbooks on tape to enhance understanding of written material, and using visual graphic organizer programs such as *Inspiration,* to aid in organizing written reports. Help seeking referred to students' use of people resources in the environment, such as asking for help teaching assistants, professors, and classmates. Academic dedication, which was measured quantitatively as the number of hours per week that students spend on their academic assignments outside of class time. In addition to the quantitative dimension, this variable also reflected qualitatively the degree of academic involvement of students, as the greater value may have implied that students who reported more studying also were more motivated and expressed greater interest in their academic work.

It appears that intellectually bright students who believe that they possess and utilize strong conceptual skills, represent effective learners who succeed in school because they exhibit similar characteristics, which are measured by standardized intelligence and aptitude scores, and which are traditionally valued and rewarded in academic settings (Aitken, 1982; Barron & Norman, 1992; Watkins, 1986). These students ordinarily do well in school if they also exhibit motivation and utilize certain self-regulated learning strategies that are of some practical utility to them (Bol et al., 1999; Garner, 1993; Pintrich & DeGroot, 1990; Schunk, 1998). On the other hand, it also appeared that for the exact same reason that these students succeed in school (i.e., because they have strong intellectual skills), they do not always have to use a similar set of self-regulated strategies across all academic settings. Another plausible explanation is that these students tend to utilize more effective study strategies (Bol et al., 1999). In fact, students' written comments on the LSSS survey provided an indication that the learning strategies these students utilize in their academic work are characterized by higher levels of complexity, practical utility, and creativity than the strategies used by students in some other groups. However, these findings may have limited generalizability, because the results are based on students' responses representing unequal group sizes.

The findings from this study are supported by previous research linking more advanced study strategies to higher levels of achievement (King, 1992a, 1992b; Pressley, Van Etten, Yokoi, Freebern, & Van Meter, 1992). For example, King (1992a, 1992b) found that summarization and self-questioning strategies used by college students led to higher academic achievement when compared to students who used other types of learning strategies. Furthermore, in accordance with Pressley's (Pressley et al., 1992) and Wittrock's (1990) theoretical models, the researcher concluded that more

elaborative and generative processing of the information accounted for those differences (Bol et al., 1999). Scott and Robins (1985) concluded that nonacademic skills and effective study methods were more valid predictors of the success of high-risk students (e.g., students with a record of poor academic performance in school) than their high school grades and standardized aptitude scores. In similar vein, Larose and Roy (1991), after reviewing a large body of research, argued that past academic performance appeared to be less predictive of students' academic performance in the first year in college for students with poor academic records at the high school level. A number of studies indicate that for this category of students, non-intellectual dimensions and self-regulated learning skills may prove to be more effective predictors of their academic success in college (Nisbett et al., 1982; Scott & Robins, 1985; White & Sedlacek, 1986).

In summary, this research was conceived as starting point in the long process of examining patterns of compex interrelationships among cognitive and non-cognitive variables and academic achievement among different groups of postsecondary students (i.e., low-, high-, and normal-achieving students and students with learning disabilities). The findings from the present study provide support for the overarching idea that we should use multiple indicators in predicting students' academic achievement status in college. Accumulated evidence indicates that in addition to acquiring knowledge, students should also develop self-regulatory competence, to achive at high levels in challenging postsecondary environments. In sum, Menges and Swinicki (1995) suggested that academic self-regulation is "an emerging area of scholarship that holds singular importance for postsecondary education: the capacity of students to regulate their own learning" (p. 1). Future research should expand the research methodology and include qualitative methods to map out the variables that may potentially affect students' academic attainment in postsecondary settings.

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Table 1

Demographic and academic characteristics of the low-achieving and high achieving students (N=328).

Category	Low Achieving Students (n=72)	High Achieving Students (n=188)
Gender	%	%
Male	45.1	27.6
Female	54.9	72.4
Mean Age	20.26	19.89
Std. Dev.	.91	1.10
Ethnicity	%	%
Caucasian	66.7	79.6
Asian	5.9	8.4
Hispanic or Puerto-Rican	8.8	2.1
Black	11.8	1.3
Not Reported	6.8	8.4
Academic Level	%	%
Freshman	33.3	26.5
Sophomore	49.0	31.0
Juniors	14.7	24.8
Seniors	2.9	17.7
GPA Range	.42 – 2.60	3.20 – 4.00
GPA Mean	1.73	3.62
Std. Dev.	.47	.33
High School Calculus	%	%
Yes	9.4	67.8
No	90.6	32.2
High School Physics	%	%
Yes	45.8	74.8
No	54.2	25.2

Table 2

Students' unadjusted mean scores on the predictor variables, Cronbach alpha reliabilities, and goodness of fit summary indices

Predictor Variables	Low Achievers (n=102)		High Achievers (n=226)		Cronbach Alpha Reliability
	Mean	Std. Dev.	Mean	Std. Dev.	
Factor 1: Conceptual Skills	3.22*	.60	3.88*	.51	.85
Factor 2: Study Routines	3.01	.79	2.85	.72	.80
Factor 3: Routine Memorization	3.17	.77	3.39	.91	.81
Factor 4: Reading and Writing Metacognitive Strategies	2.96	.68	3.11	.73	.70
Factor 5: Compensatory Supports	1.70*	.52	1.24*	.41	.70
Factor 6: Help Seeking	2.86*	.77	2.48*	.82	.70
Academic Dedication	3.10*	1.49	3.60*	1.30	N/A
Perceived Benefits of SRL Strategies	2.45	.98	2.75	1.02	N/A
Perceived Usefulness of SRL Strategies	2.41	1.51	2.99	1.51	N/A
High School Rank	68.04*	16.03	94.84*	5.23	N/A
Goodness of Fit Summary	χ^2	df	TLI	CFI	RMSEA
	1080.63	147	.90	.91	0.038

* $p < .001$

Table 3

Indicators of Fit for Hierarchical Logistic Regression

Indicators of Fit	Block 1	Block 2	Block 3	Block 4	Block5
G^2	1256.702	473.140	414.496	406.448	232.079
df	469	467	463	456	443
G^2/df	2.67[illegible]	1.750	0.895	0.891	0.523
Pseudo R^2	.032	.547	.572	.575	.641
PCP	68.2%	93.0%	91.5%	91.1%	96.5%
Change in G^2		783.562	58.64	8.048	174.369
Change in *df*		2	4	7	13
Improvement of fit (p-value)	.000	.000	.000	.045	.000

Note. The following new variables were entered in each block at every step:

Block 1: Gender

Block 2: High School Rank

Block 3: High School Calculus and High School Physics

Block 4: Perceived Usefulness of Self-Regulated Learning Strategies, Global Assessment of Perceived Benefits of Using Self-Regulated Strategies, and Academic Dedication

Block 5: Six Self-Regulated Learning Strategies: Conceptual Skills, Study Routines, Routine Memorization, Reading & Writing Metacognitive Strategies, Compensatory Supports, and Help Seeking.

Table 4

Final Hierarchical Logistic Regression Parameter Estimates

Factor	Beta Weight	S.E	Significance Level	Exp (B) (Odds Ratio)
Gender	1.612	.436	.000**	5.011
High School Rank	.221	.023	.000**	1.248
High School Calculus Course	3.336	.527	.000**	28.099
High School Physics Course	.437	.379	.250	1.548
Perceived Usefulness	.019	.150	.898	1.019
Perceived Benefits	.622	.210	.003**	1.862
Homework	-.176	.153	.248	.838
Conceptual Skills	2.752	.442	.000**	16.666
Study Routines	-.203	.340	.552	.817
Routine Memorization	-1.861	.348	.000**	.156
Reading & Writing	-.253	.308	.412	.777
Metacognitive Strategies				
Compensatory Supports	.329	.228	.149	1.389
Help Seeking	-.871	.313	.005**	.418

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

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