A Comparison of Two Standardized Measures for Evaluating Academic Competence in College Students

Lauren M. Hutto
THE FLORIDA STATE UNIVERSITY
COLLEGE OF EDUCATION

A COMPARISON OF TWO STANDARDIZED MEASURES FOR
EVALUATING ACADEMIC COMPETENCE IN COLLEGE STUDENTS

BY
Lauren M. Hutto, B.S.

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The members of the Committee approve the dissertation of Lauren M. Hutto defended on August 16, 2004.

________________________________________________________
Frances Prevatt
Professor Directing Dissertation

________________________________________________________
Andrew Oseroff
Outside Committee Member

________________________________________________________
Gary Peterson
Committee Member

________________________________________________________
Briley Proctor
Committee Member

Approved:

________________________________________________________
Frances Prevatt, Chair, Department of Educational Psychology and Learning Systems

The Office of Graduate Studies has verified and approved the above named committee members.
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ABSTRACT

The term “academic competence” was coined by Elliott and DiPerna (2000) to describe the entire set of skills and behaviors necessary to achieve success in school. However, the components that comprise the idea of “competence” vary between instruments and academic institutions. The purpose of this study was the examine the extent to which two instruments that purport to measure competence can differentiate between extreme academic groups of students, to determine the overlap in terms of data derived from these instruments, and investigate the extent to which data derived from these instruments can aid in the prediction of college performance. Two separate MANOVA procedures were statistically significant for differences between groups in terms of scores on these instruments. Two canonical roots were derived indicating significant overlap among the scales that comprise these instruments. Finally, hierarchical regression results indicated that these instruments contribute comparatively little information in the prediction of semester grade point average in comparison to previous performance. Implications and conclusions are discussed.
In the field of school psychology, there are an abundance of instruments that purport to measure individual ability. While this lends to flexibility in assessment practices, it also complicates the process of diagnosis and treatment planning; using different instruments may yield different results, thus impacting subsequent actions taken by professionals. This calls into question the validity of the measures currently used in the field. Thus there is some concern over the appropriateness of the measures used in assessment practices and the utility of their findings. These questions are particularly salient when considering the introduction of a new instrument.

Many instruments exist to measure intelligence, achievement, cognitive processing, learning styles, study skills, and behavior. However, as students mature, fewer and fewer instruments become available for the practice of assessing psychoeducational factors. Likewise, the focus gradually shifts from that of intelligence and aptitude, to study skills, personality, and behavior. What remains constant across time is the interest in performance prediction based on the use of these measures. As well, there is a pervasive interest in using data to classify individuals into parsimonious groupings that allow discussion of general characteristics. While having fewer instruments to choose from may reduce the risk of variable findings that is inherent when choosing from multiple measures, it heightens the need for measures that are reliable and valid. Therefore, it is appropriate to study those instruments that currently exist and those that are emerging, as a means of gaining a deeper understanding of the information they yield, as well as determining their appropriateness for clientele.
Social Significance of the Study

Many students who come to college are expected to perform well. In fact, the admissions systems at most colleges are set up such that students must meet certain criteria before being accepted at that particular institution. The admissions criteria chosen by most colleges are believed to be predictive of college performance and often entail measures such as high school grade point average and college entrance exam scores. However, these estimates of performance may not take into account other factors related to later success in college. As such, some students who are admitted into college under the premise that they will be successful perform poorly at the college level. This phenomenon calls into question the usefulness of such traditional measures with all students.

Professionals in learning centers on college campuses are faced with the responsibility of determining why students struggle with college-level curriculum, and distinguishing between poor-performing students with and without a Specific Learning Disability. In some cases, these students can be easily distinguished through intelligence, achievement, or cognitive processing measures, thus allowing hypotheses to be derived that explain why a student is struggling. However, there are students for whom the source of academic difficulty remains unknown. In fact, students who by all indications should be performing well in college may continue to struggle without a discernable explanation. The question is then “why?” According to DiPerna and Elliott (1999), the notion of “academic competence” can be important in understanding college performance and helping differentiate between achievers and non-achievers.

DiPerna and Elliott (1999) define academic competence as the academic skills (reading, math, writing, etc.) and the academic enablers (study skills, motivation, etc.) that contribute to student success; however, the components of academic competence may vary depending on the instrument one uses or the institution in which it is employed. Given that students vary from one another, as well as between academic subjects, it is an intuitive conclusion that they will differ in terms of academic competence. The social questions of interest address the utility of the measures being used to measure academic
competence. Specifically, what do current measures of competence tell us about student groups and are there detectable differences? Are these measures useful in terms of predicting how a student will perform in the college setting? Knowledge of test utility and differences between students takes the professional responsibility of education one step closer to increasing the probability of success for more students attending college.

**Professional Response**

The components of academic competence are a point of contention among professionals, as is the exact relationship between study skills and academic skills. Yet, it is our professional obligation to continue to research the nature of the relationship to gain a better understanding of competence and how to foster it. Depending on the model one examines, study skills are either treated as a separate entity from academic skills or are subsumed under them. In the former model, study skills should be assessed as a separate entity from traditional psychoeducational measures. Under the latter model, the results of one’s study skills are reflected in both psychoeducational data and grades.

Regardless of the model, the measurement of academic competence (that entails both academic skills and enablers) is in need of instruments with higher levels of reliability and validity in terms of predicting academic success. For example, psychoeducational testing is designed to estimate a student’s performance in school; however, it does not measure all the reasons students may perform poorly in class. This is especially true if the student appears to have the academic skills necessary to perform in a particular subject area. In contrast, students who appear to have poor study skills may perform at an acceptable level. These cases call into question the adequacy and the validity of the measures currently being used to measure competence.

To answer the question of competence, DiPerna and Elliott (2001) have proposed a newly designed instrument, the Academic Competence Evaluation Scales – College Edition (ACES). According to these authors, information from the ACES can be useful in discriminating between students with learning disabilities and students without learning disabilities, as well as providing information regarding a student’s academic skills and enablers that can be used in program planning. The ACES is divided into two domains: Academic Skills and Academic Enablers. The Academic Skills domain is
divided into three subdomains: reading/writing, math/science, and critical thinking. The Enablers domain is subdivided into four subdomains: motivation, study skills, engagement, and interpersonal skills. The scales were originally developed for teachers to provide ratings of student performance for grades K-5. The scale was extended twice to encompass self-reports of students in high school and college. Research indicates varying support for retention of the four Academic Enabler domains with college students, with the least support for retention of the Interpersonal Skills domain.

A second measure, the Learning and Study Strategies Inventory (LASSI) is also used to evaluate students’ study skills and learning strategies. Unlike the ACES, it does not attempt to discriminate between students in terms of academic skills. Rather, the LASSI can be used in conjunction with traditional psychoeducational measures to obtain both academic and non-academic skills information. The LASSI is organized into 10 scales: anxiety, attitude/interest, motivation, time management, information processing, selecting main ideas, self-testing, testing strategies, concentration, and use of support techniques. These scales are designed to measure both cognitive and affective aspects of learning. There is some question regarding the LASSI’s ability to differentiate between high, low, and average achieving students (Haynes, Comer, Hamilton-Lee, Boger, and Joyner, 1987), as well as the appropriateness of the LASSI for use with low achieving students (Nist, Mealy, Simpson, and Kroc, 1990; Deming, Valeri-Gold, and Idelman, 1994).

According to the AERA’s Standards for Educational and Psychological Testing and Federal regulations such as the Individuals with Disabilities Education Act of 1997 (IDEA 1997), evidence of validity should be presented for the major types of inferences for which a test is recommended (standard 1.1). Further, when using a test to distinguish between groups, the ability of the test to discriminate between groups should be established through additional evidence (standard 1.23). Before using a measure, evidence must be presented to support the validity of the measure. As such, it is the professional and legal (i.e., Individuals with Disabilities Education Act, 1997) responsibility of school psychologists to use only validated measures. As well, it is our professional responsibility to have a profound understanding of how to most appropriately employ the measures we use to assess performance.
Furthermore, the field of school psychology needs to continue to explore the accepted belief that group differences truly exist and can be used to justify our differential approach to providing support at the college level. As a profession, we need a deeper understanding of the components of successful learning, to facilitate service delivery. To that end, this study is designed to investigate questions regarding the utility of the ACES – College and the LASSI, as well as the statistical and practical significance of the information these instruments yield when examining differences between groups of students. A secondary goal of this study aims to explore what, if any, differences exist between student achievement groups with regard to performance on these measures.

Statement of the Problem

Both the ACES and the LASSI are purported to measure academic competence, but it is unknown how well they discriminate among students with and without learning problems. If an instrument cannot discriminate between groups that are believed to differ on the construct of interest, then the instrument does not provide meaningful information. Therefore, it is important to assess the degree to which these two instruments can differentiate between groups of students, or detect differences if they truly exist. In addition, it is important to understand what, if any, unique contribution the ACES – College and the LASSI can make to current psychoeducational assessment practices for students in college. In other words, are the two measures redundant? Furthermore, do either, or both, add information when combined with student grades or college placement test scores? Using this information, can we predict how a student will perform in college based on additional information provided by the LASSI and/or the ACES?

Purpose of the Study and Formal Research Questions

The purpose of this study is to investigate if the ACES and the LASSI can differentiate between students with a learning disability, low achieving students, and students without learning problems (comparison group). The specific analyses will
examine statistical differences in scores between students with learning disabilities, low achieving, and comparison group students on the ACES academic skills scales (reading/writing, math/science, critical thinking, and total) and academic enablers scales (motivation, study skills, engagement, interpersonal skills, and total). It will also examine statistical differences between these three groups in terms of scores on the ten subscales of the LASSI. As well, this analysis is designed to determine the ability of each instrument to correctly classify students into one of three achievement groups. This information will be used to determine not only if differences exist between these student groups, but also which scales from the ACES and the LASSI are best able to detect these differences. As well, this analysis will yield important information regarding which scales from these instruments are most discriminatory, and how these instruments perform (as a whole) in their attempt to differentiate student achievement groups. This analysis is reflected in the following research questions:

1. What is the relationship between group membership (students with learning disabilities, low achieving, and comparison group students) and scores on the ACES?

2. What is the relationship between group membership (students with learning disabilities, low achieving, and comparison group students) and scores on the LASSI?

The second analysis will examine the degree of overlap between scales on the ACES and the LASSI to determine if the scales provide redundant information. This is addressed in the following research question:

3. What is the relationship between scores on the LASSI and scores on the ACES?

The third analysis relates to the predictive power of the LASSI and the ACES. Specifically do the LASSI or the ACES add any predictive power when determining academic success (as measured by current GPA) beyond that explained by: group membership, high school GPA, or college placement test scores (e.g., SAT)? The following research questions were developed to address whether the ACES or LASSI (raw) scores account for additional variance in the prediction of current GPA over and above the variance accounted for by high school GPA, college entrance exams, and LD status (learning disability, low achieving, or comparison group)?
4. What is the relationship between high school academic GPA, college entrance exam scores (SAT, ACT, or CPT), group membership, and total scores on the ACES in terms of predicting semester GPA?

5. What is the relationship between high school academic GPA, college entrance exam scores (SAT, ACT, or CPT), group membership, and scores on the LASSI in terms of predicting semester GPA?

6. What is the relationship between high school academic GPA, college entrance exam scores (SAT, ACT, or CPT), group membership, scores on the LASSI, and scores on the ACES in terms of predicting semester GPA?

Definitions of Terms

Students with a learning disability: Students diagnosed with a Specific Learning Disability according to standards adhered to by the Adult Learning Evaluation Center (ALEC) Florida State University campus.

Low Achieving: Students who self-refer to the Adult Learning Evaluation Center for the purpose of psychoeducational testing to determine presence of a Specific Learning Disability, but do not meet the diagnostic criteria according to ALEC standards.

Comparison: Students who voluntarily participate in the study who have never been diagnosed with a Learning Disability or Attention-Deficit/Hyperactivity Disorder, and currently have a college grade point average of 2.5 or higher.

GPA: Unweighted grade point average.

Semester GPA: Grade point average for the semester in which the LASSI and the ACES were administered.

College Entrance Exam scores: Scores from the Scholastic Aptitude Test (SAT), the American College Test (ACT), and the College Placement Test (CPT) (for Community College students).

Group Membership: Group assignment of students into one of three groups: students with a learning disability, low achieving students, or comparison students.
Academic achievement has long been accepted as the hallmark of success in college for the traditional college student. This type of success is typically measured using grade point average (GPA). Likewise, measures such as the American College Test (ACT) or Scholastic Aptitude Test (SAT) scores and high school GPA are often used to predict college performance.

Unfortunately, there is some evidence that contraindicates the use of such standardized test scores in the prediction of college performance, especially when trying to predict beyond the first semester. Particular aim has been taken against the SAT. Originally, the SAT was designed to serve as an intelligence test for college admissions and was intended to predict student success in the college institution despite being under-prepared by high school courses (Lawlor, Richman, & Richman, 1997). However, as with many standardized instruments, the information gleaned from the SAT has been misused and/or misinterpreted by many educational decision-makers (Powell & Steelman, 1996).

Some research has also indicated that the use of SAT scores falls short of its goal to predict college student performance, especially for non-white students (Lawlor, et. al., 1997). However, most researchers would probably agree that the SAT is more powerful (and perhaps, more accurate) when used in conjunction with other variables (i.e., class rank, GPA) (Stricker, Rock, & Burton, 1996; Lawlor et. al, 1997; Baron & Norman, 1992; and Ting & Robinson, 1998).

Pettijohn (1995) examined the relationship between high school GPA, college GPA, and ACT composite scores. Significant correlations were found between high school GPA and college GPA, college GPA and ACT composite scores, and ACT composite scores and high school GPA. The combination of high school GPA and composite ACT scores demonstrated a moderate to strong correlation with college GPA. Given the strong relationship when considered in combination, Pettijohn (1995) suggested that scores on the ACT should not replace high school grades in the prediction
of success. Specifically, when these scores are considered in combination, the predictive ability is increased. This indicates that those students who did well in high school and performed well on college entrance exams, are also likely to do well in college.

Wilczenski and Gillespie-Silver (1992) investigated the performance of students with and without learning disabilities by using SAT scores and high school percentile rank to predict performance in college and to determine the ability of this information to distinguish between groups. In summary, class rank was found to be useful in predicting first-year GPA for both groups (overall classification rate of 62.25%), but this is not surprising as past performance is likely a good predictor of future ranking. Interestingly, the authors also found a group of students with learning disabilities that were predicted to do poorly based on high school rank alone, who actually performed well; these students were found to have significantly higher SAT Verbal test scores when compared to low-achieving students with learning disabilities.

These studies provide evidence for the importance of academic skills in the prediction of college performance. However, academic ability is not the only important skill related to college achievement. In 1974, McCausland and Stewart conducted a study to determine the relative importance of factors contributing to college success, namely academic aptitudes and study skills. The results of the study suggested that high school GPA and ACT composite scores are the best predictors for selection purposes, and the addition of other variables to a regression equation added little to predict college GPA. However, the authors did not discount the usefulness of study skills and other non-academic factors in the prediction of success. Rather, they suggested that study skills and academic aptitude are already predictors of performance in high school, thus they are already contained indirectly in regression equations used for prediction. Furthermore, the effects of aptitude and study orientation are not additive, as students use differential amounts of each to get by (McCausland & Stewart, 1974).

In a review of literature examining the prediction of academic success in higher education, Mouw and Khanna (1993) noted that the practice of using high school grades to predict success has been popular since 1917. In their review, the authors focused on studies that reported prediction of college performance, as well as the degree of the relationship reported, and used this information to conduct a secondary study in which
the utility of traditional measures (i.e., high school performance, college entrance exams, etc.) was evaluated. Based on predictors suggested from the literature, Mouw and Khanna (1993) found that 30% of the students predicted to succeed (using traditional measures) in fact failed, while 50% of those students predicted to fail remained in good standing with their respective university. These findings suggest that traditional predictors of college success are less than perfect, especially if extended beyond the first few semesters in college. This is consistent with the position of Linn and Dunbar (1982) who stated that the use of traditional methods of prediction, in isolation, for correlation analysis may lead to inaccurate estimations of predictive validity.

Gadzella and Williamson (1984) hypothesized that there is a relationship between study skills, self-concept, and academic achievement (as measured by GPA), as they relate to the prediction of GPA. According to their results, there are positive correlations between self-concept, study skills, and achievement, and between study skills and self-concept. Thus, it may be that effective study skills foster success in school, which influences self-concept. Notably, when all variables were considered concurrently, a total score on the study skills construct was the best predictor of grade point average (Gadzella & Williamson, 1984).

In a similar vein, Larose and Roy (1991) cited a variety of research indicating that predictions of success in college should not be limited to academic factors. In this particular study, anxiety, study strategies, student beliefs concerning success, motivation, and high school GPA were used as predictors of first-semester college performance. Their findings suggest that while successful students often have higher high school GPA’s, they also anticipate success, give priority to study behaviors, are prepared for exams, and demonstrate attentiveness in class. For those students with poor academic records in high school, past academic performance was less predictive of success. Students who were considered “at risk”, yet performed well in college, demonstrated a willingness to give priority to studies, adopted successful study behaviors, insured personal goal direction, held realistic beliefs about how success is achieved, interacted effectively with peers and faculty, and were able to control anxiety (Larose & Roy, 1991). Again, the formula for success in college extends beyond traditional academic
measures to include such variables as motivation, study skills, interpersonal skills, and task engagement.

There is some evidence to suggest that student variables exert one of the most direct influences on academic achievement in young children (DiPerna, Volpe, & Elliott, 2002). Specifically, prior achievement has the largest direct effect on current achievement. According to a model proposed in 1981 by Walberg, academic success can be attributed to nine student variables: ability/prior achievement, motivation, age/developmental level, quantity of instruction, quality of instruction, classroom climate, home environment, peer group, and exposure to media outside of school (DiPerna et al., 2002).

Taken together, these studies emphasize the importance of both academic skills and nontraditional academic factors when considering the characteristics of successful students. In other words, while academic performance is an obvious hallmark of the successful student, nontraditional academic factors also play an important role. In fact, Russell and Petrie (as cited in Hirsch, 2001) noted that 13 different factors have been identified that influence academic performance. These have been classified into three broad categories: academic factors, social/environmental factors, and personality factors. According to Hirsch (2001), students may struggle in the academic college environment for a number of reasons, including: deficits in emotional and motivational readiness, deficits in academic preparation for college work, deficits in college-level study skills, deficits in effective use of personal learning style, and/or presence of a disability.

Thus, the term achievement takes on a different meaning when considering both traditional and nontraditional academic factors related to college performance. DiPerna and Elliott (2000) proposed the term “competence” as a means of describing both traditional and nontraditional academic factors. According to DiPerna and Elliott (2000), the construct of competence, although more comprehensive than traditional measures of academic success, is somewhat elusive. These authors define academic competence as a multidimensional construct pertaining to the skills, attitudes, and behaviors that a learner needs to contribute to academic success (DiPerna & Elliott, 2000). Using this nomenclature, skills are considered traditional academic skills that are well-accepted
predictors of college performance. Attitudes and behaviors are believed to represent nontraditional factors associated with academic performance.

Components of Academic Competence

Academic skills are only briefly considered here, as these are well accepted as being paramount in college, and have been indirectly established in the previous section. It is recognized that students must demonstrate a certain level of reading, writing, mathematical, and critical thinking ability in order to handle a college curriculum. While most colleges set minimum criteria for admissions, the choice of measures to assess these criteria are typically constant across institutions and are traditionally those that were previously discussed (i.e., GPA, ACT, SAT).

Academic competence is defined somewhat differently depending on the instrument used to assess it. While it is clear that there are many nontraditional skills needed for success in college, it is difficult to distinguish between them in terms of importance. However, several areas have received emphasis in the research literature and instrument construction, indicating their relative importance in terms of academic competence. The broad areas that are addressed in this review include: motivation and goal regulation, study skills and information processing, time management, note taking, academic engagement, and interpersonal skills and adjustment.

Motivation and Goal Regulation

As part of a project designed to determine which factors are useful in predicting who benefits most from higher education and why, Cote and Levine (2000) proposed an integrated paradigm of student development. According to this model, student readiness, or motivation to benefit and actively engage educational settings, interacts with the setting, which should be ready to challenge the bright student, thus producing a goodness of fit that fosters intellectual growth; the setting provides challenges to the student who is ready to be challenged. If this match between student and setting is achieved, then educational outcomes should be positive. Therefore, success ultimately equals the fit between the student and learning environment. The essential input is student readiness, which hinges on motivation to do well; however, student readiness is typically seen as a
level of intellectual ability. Based on the findings of their research Cote and Levine (2000) argue that motivation is more important than intelligence in terms of student adjustment, quality of education, development of human capital skills, and academic achievement. Furthermore, motivation appears to be a more important factor for average or low achieving students compared to students with higher intellectual ability (Cote & Levine, 2000).

Cote and Levine (2000) concur with a long lineage of research related to the importance of motivation and achievement goals on school performance. According to Dweck (1986), achievement motivation (involving academic competence) has been linked to learning (mastery) and performance goals. Mastery/learning goals are associated with challenge-seeking behaviors, as these goals are primarily concerned with effort and progress. In contrast, performance goals center on concerns about ability levels, thus fostering competition. In other words, student satisfaction via performance goals is related to what is achieved or displayed (i.e., GPA, class ranking, etc.), whereas mastery goals are linked to effort and pursuit of the goal (i.e., personal development and knowledge). The choice between these goals is believed to be linked to student values and perceptions of both the learning environment and their skills. In short, there appears to be a link between what motivates a student (learning versus competition) and the academic goals they choose (mastery versus performance).

Dweck (1986) also emphasized that children with performance goals are more likely to attribute failure to lack of ability rather than external features or poor task use; in other words, the failure is related to personal qualities. In contrast, adaptive behavior patterns are most closely associated with mastery goals. Adaptive motivational patterns are synonymous with attainment of knowledge, and use personally challenging and valued achievement goals to increase learning (Dweck, 1986).

In 1997, Harackiewicz, Barron, Carter, Lehto, and Elliott sought to provide further understanding regarding the personality predictors of achievement goals in college classrooms and the consequence of goal selections. The authors looked at students’ adoption of mastery, performance, and work avoidance goals (doing as little as possible to get the grade) as these relate to intrinsic motivation and performance. Their findings indicated that differences in achievement motivation were likely to influence
academic goals. In other words, students who were oriented toward hard work, desire to do a good job, prefer challenging tasks, and prefer meeting internalized standards of performance, were more likely to adopt mastery goals (Harackiewicz et al., 1997). In contrast, students who were competitive were more likely to use performance and work avoidance goals; students who adopted the work avoidance goals were also more likely to be motivated extrinsically and to use superficial study habits such as rote memorization (Harackiewicz et al., 1997).

According to Harackiewicz et al. (1997), students who adopted mastery goals were more likely to demonstrate higher levels of interest in the class, whereas those who used performance goals were more likely to obtain higher course grades. This seems counter to previous research that alludes to the adaptiveness of mastery goals in the learning environment. As a means of explaining this interesting pattern, Harackiewicz et al. (1997) proposed that students who endorse performance goals are highly motivated, thus they work harder and process the course material at a deeper level, thereby doing whatever is necessary to obtain a good grade. However, performance students who are successful may engage in superficial processing, as this is all that is required in the college context. Furthermore, Harackiewicz et al. (1997) proffered that mastery goals may not be directly related to college grades due to the testing requirements in the college context. In other words, few college courses offer grades based on your love of learning as opposed to meeting an external criterion of performance. Thus, (the few) courses that require deeper processing may be more related to mastery goals than typical college courses, or mastery goals may exert an indirect effect. Likewise, mastery goals may be more related to long-term effects such as task involvement, independent study, or other factors related to perseverance in college (Harackiewicz et al., 1997).

In line with their 1997 study, Harackiewicz, Barron, and Elliott (1998) proposed that success in a competitive educational setting may be dependent on the goals a student pursues. In other words, if the goals of the institution are based on competition or development of knowledge, the goal sets will differ. While success is usually defined in terms of academic performance (most commonly grades), it may also be measured in terms of intrinsic interest or intrinsic motivation (Harackiewicz et al., 1998). According to Harackiewicz et al. (1998), intrinsic motivation concerns the quality of the educational
experience as it relates to a student’s tendency to be actively involved in coursework, enjoy lectures, classes, and readings, love learning, and ask questions. This type of motivation is particularly important at the college level, as it typically dictates the program of study.

Based on a 1991 model designed by Harackiewicz and Sansone, Harackiewicz et al. (1998) proposed that academic goals are pursued on two levels: purpose goals (general reasons for task engagement and the reasons why a person engages in a task) and target goals (guidelines that provide concrete standards for actions in a specific situation). According to this model, these goal types are related to dispositional values and classroom environmental demands, respectively; however, there is a transaction between the levels. In other words, goal selection is most likely a combination of the demands of the context, as well as the values that the learner brings to the context. Thus, when examining student motivation, one must look at environmental demands and personality factors. According to Harackiewicz et al. (1998), mastery and performance goals both enhance intrinsic motivation, but the increase is dependent on the personality of the individual. Furthermore, intrinsic motivation is likely to be enhanced regardless of the personality style, if target goals are congruent with process goals (Harackiewicz et al., 1998). Stated another way, the purpose of the target activities should be to the same ultimate end as the process activity. Thus, performance goals in the college classroom may best facilitate grade performance while mastery goals facilitate interest or intrinsic motivation. However, students who endorse both goals are most likely to obtain both outcomes (Harackiewicz et al., 1998). To extrapolate, the ideal learner simultaneously engages in strategies that facilitate obtaining good grades (performance goals) and foster intrinsic interest in learning (mastery goals).

Continuing to develop this idea, Wolters (1998) argued that there is limited research concerning the type of behaviors students use when faced with motivational problems. Specifically, he proposed that there are three situations in which motivation is reduced: learning material is boring or uninteresting, learning material appears irrelevant or unimportant, and increasing difficulty of the task. Wolters (1998) noted that students engage in different strategies dependent on the source of motivation (i.e., intrinsic vs. extrinsic), and that these are related to different outcomes. Specifically, students who are
intrinsically motivated typically persist longer, are more deeply engaged in tasks, and show more adaptive cognitive and achievement outcomes (Wolters, 1998).

In his 1998 study, Wolters attempted the following: 1) to identify strategies students use to regulate motivation, 2) to explore the extent to which strategy use is dependent on the reason for waning motivation, and 3) to discover the relationship between use of strategies (for regulating intrinsic and extrinsic motivation) in relation to goal orientation, use of cognitive strategies, and course grades. Students were found to use 14 different categories of strategies for regulation of motivation. The most commonly endorsed strategies included those designed to control the cognitive aspects of the tasks. Specifically, students sought out ways to make the tasks more manageable and employed these strategies when tasks were perceived as becoming more difficult. Students also engaged in manipulation of goals, reasons, or desires for completing the tasks. According to Wolters (1998), for some students this translated into increasing intrinsic motivation (boosting value or interest in the topics, tying the material to their lives, etc.) or adding extrinsic motivation.

In the Wolters (1998) study, the way in which students regulated motivation was believed to be linked to other aspects of self-regulation. For example, in this study, intrinsically motivated students had stronger learning goal orientation and a link was found between global beliefs and attitudes about the way they engage in academics, and strategies used to guide behavior in those tasks. This is in line with Dweck (1986), who stated that performance goals are poorly linked with intrinsic motivation, thus persistence in the face of difficulty is likely to wane. In the Wolters (1998) study, students who reported intrinsic motivational strategies also reported using strategies such as elaboration, critical thinking, and metacognitive regulation; on the other hand, students using extrinsic motivational strategies demonstrated higher grades.

Building on this idea, Ley and Young (1998) argued that deficits in self-regulation rather than existence of a disability explain why many students are unprepared for college. Research from Zimmerman, and Zimmerman and Paulsen, (as cited by Ley & Young, 1998) reported that the defining characteristics of self-regulated learners include goal directedness, academic time management, meaningful and directed practice, use of self-management and metacognitive strategies, and self-efficacy. It is suggested
that students demonstrating academic difficulties may plan, organize, monitor, evaluate, or reflect about learning processes in a fundamentally different manner than regular students (Ley & Young, 1998). Thus self-regulated learners may be fundamentally different from low achievers.

Based on their research, Ley and Young (1998) concluded that use of self-regulatory strategies was able to differentiate between “developmental” (or struggling) and “regular” (or achieving) students, and that the frequency with which “regular” students used self-regulatory strategies was greater than that of students demonstrating academic difficulty. This is closely related to VanZile-Tamsen and Livingston’s (1999) finding that high and low achievers differ in self-regulated strategy use, with high achievers reporting greater use of strategies, which may be implicated in their success. Under-prepared learners may self-refer for a learning disability evaluation, when the deficit actually exists in their use of self-regulatory strategies.

Returning to the topic of motivation, it seems that successful students maintain motivation and adapt motivational schemes to fit the demands of the situation. Jakoubek and Swenson (1993) attempted to identify differences between use of learning strategies among students in four-year colleges. These authors suggested that the understanding of learning and studying is a developmental process that improves over time. Specifically, the authors noted that scores on deep processing and elaborative processing (i.e., critically thinking about the information in an attempt to understand it on a deeper level) were found to be higher for people with more years in college, with huge differences seen between freshmen and upper classmen. This finding is suggestive of two conclusions. First, students may adopt these strategies in relation to the demands of the academic institution. In other words, as classes become more difficult, students may adapt a deep processing approach to meet the demands. On the other hand, students may develop deeper processing naturally as it is related to mastery goals. If this is the case, then students adopt the deeper processing and the mastery goals to increase intrinsic motivation and provide self-support for succeeding in college.

Up to this point, motivation and achievement goal literature has been addressed in terms of a dichotomy between performance and mastery goals. However, Elliott and Harackiewicz (1996) propose that performance achievement goals should be further
subdivided to include approach and avoidance, thus a trichotomous model including mastery, performance approach, and performance avoidance goals is most appropriate. In this model, performance approach and mastery goals represent self-regulation according to positive outcomes and engender affective and perceptual-cognitive processes that facilitate optimal task engagement. Both mastery and performance approach goals are believed to promote intrinsic motivation, as individuals will perceive the achievement setting as a challenge, which will generate excitement, encourage investment, facilitate concentration and task engagement, and orient the learner toward information that is likely to facilitate intrinsic motivation (Elliott & Harackiewicz, 1996). In contrast, performance avoidance goals are grounded in self-regulation according to negative outcomes, and evoke self-protective processes that interfere with optimal task engagement and lead to helpless motivational responses (Elliott & Harackiewicz, 1996). Thus, according to Elliott and Harackiewicz (1996), performance-avoidant individuals see the environment as threatening and therefore suffer from anxiety, withdrawal, disruptions in concentration and task engagement, and center attention on failure; this is likely to decrease intrinsic motivation.

In an extension of this model, Elliott and Church (1997) conducted a study to investigate personality and expectancy-based antecedents of goal adoption, explore the consequences of goal adoption on intrinsic motivation, differentiate between the approach forms of motivation, and test a hierarchical model of approach and avoidance achievement motivation. Using Elliott and Harackiewicz’s (1996) trichotomous model of motivation, Elliott and Church (1997) proposed a structural equation model in which motive dispositions (fear of failure and achievement motivation) influence the adoption of achievement goals (mastery, performance approach, performance avoidance), while competence expectancies (expectations of failure or success) also influence achievement goals, independently of dispositions. Achievement goals directly influence achievement relevant outcomes (intrinsic motivation or grade performance).

Using their structural equation model, Elliott and Church (1997) found that mastery and performance avoidance goals were linked to achievement motivation and fear of failure, respectively; however, performance approach goals were linked to both. Mastery and performance approach goals were linked to high competence expectations,
whereas performance avoidance goals were linked to low competence. Furthermore, mastery goals were found to be related to intrinsic motivation, but had no influence on graded performance; performance approach goals had a positive relationship to grade performance, but a null relationship to intrinsic motivation. Performance avoidance goals were deleterious for both intrinsic and grade performance motivations. Such findings suggest that students who adopt both mastery and performance approach goals are more likely to achieve intrinsic motivation and grade performance (Elliott & Church, 1997).

Elliott, McGregor, and Gable (1999) conducted two studies to examine the three levels of goals (mastery, performance approach, and performance avoidance) in relation to the metacognitive domains used by Entwistle and Waterston (deep processing, surface processing, and disorganization) in their 1988 study of university students’ approaches to studying. They also incorporated the motivational domains of persistence and effort in their analysis, as well as the relationship between study strategies and exam performance as mediators to achievement goals and performance. Their findings are summarized as follows:

- Performance approach goals were positively related to exam performance, performance approach goals were positively related to surface processing, persistence and effort, and persistence and effort mediated the relationship between performance approach goals and exam performance.
- Performance-avoidance goals were negatively related to exam performance, positively related to surface processing and disorganization, negatively related to deep processing, unrelated to persistence and effort, and disorganization mediated the relationship between performance avoidance goals and exam performance.
- Mastery goals were unrelated to exam performance, but positively related to deep processing (or more thorough engagement of the material for the purpose of understanding).
- Deep processing was positively related, disorganization was negatively related, and surface processing was unrelated to exam performance, but the positive relationship between deep processing and exam performance was eliminated when GPA was controlled.
• Deep processing, persistence, and effort were positively related, disorganization was negatively related, and surface processing was unrelated to exam performance.

Taken together, Elliott et al. (1999) propose that these results support a multi-stage model in which exam performance is mediated by approach-avoidance goals and strategy use. Furthermore, these authors proffer that the manner in which competence is defined (mastery or performance), as well as the way in which it is framed (approach or avoidance) comprise achievement goals.

These findings are similar to those of Nolen (1988), who found that students with mastery orientations were more likely to use deep processing strategies. Furthermore, Bergin (1995) found that students with both high and low GPA’s performed well in mastery situations; however, in competitive situations, low ability students perform more poorly. These findings support the contention that mastery situations are more adaptive than competitive situations for students with low ability.

Unfortunately, Bergin (1995) also pointed out that American culture and schools tend to emphasize a competitive approach to learning despite the fact that mastery orientations have been proven more adaptive through research. Building on this claim, although mastery goals are typically viewed as superior, Barron and Harackiewicz (2001) note that performance goals may also be adaptive for certain environments and that multilevel goals may be appropriate. These researchers found that students who adopted both mastery and performance goals are more likely to become interested in and perform well in the learning environment. Thus, motivation is a key piece for success in college. Furthermore, the ideal learner is one who can simultaneously engage in mastery and performance goals.

Motivation, although a significant contributor to academic success in college, is not the only factor related to performance. Specifically, there is also a need for metacognitive strategies related to the way in which one acquires, organizes, and integrates information. Likewise, there is great importance placed on ones’ ability to manage competing goals and to demonstrate general adjustment in the college context. 

*Study Skills and Information Processing*

According to Harvey (1995), study skills are defined as competence in acquiring, recording, organizing, synthesizing, remembering, and using information and ideas, and
are among the skills that can be modified for learners of all ages. However, this category tends to be somewhat broad, and may appear different when looking at different academic institutions. For example, if one were to do a general search on the Internet using the term “study skills” or “study strategies”, one would encounter a number of web sites (most supported through an educational institution) touting the importance of a specific subset of skills. One would also notice that there is considerable overlap among these sites, yet no site is identical. A similar pattern is noted among books and manuals that emphasize study skills and nontraditional academic factors.

According to Harvey (1995), study skills include skills of organization, memorizing, and using ideas; this may also be referred to as information processing. Other authors have defined study skills differently. For example, Gadzella and Williamson (1984) stated that study skills are composed of behaviors and attitudes that include time management, organization, motivation and concentration. The Learning and Study Strategies Inventory (LASSI) (Weinstein, 1987) identified ten areas (five skills areas and five affective areas) of importance when considering nontraditional academic factors: attitude, motivation, time management, anxiety, concentration, information processing, selecting main ideas, study aides, self-testing, and test strategies.

Archer and Gleason field-tested and revised learning strategies for students in grades three through six, and narrowed important skills down to include skills related to reading, organizing information, and test taking, among others (Gleason, Archer, & Colvin, 2002). Strichart and Mangrum (2002) identified learning and study skills related to memorizing, reading, note taking, interpreting graphics, use of study time, test preparation and test taking, paper writing, selecting main ideas, and encountering new vocabulary. Heinrichs and LaBranche (1986) conducted a content analysis of 47 college learning skills texts and created a checklist denoting the overlapping features emphasized among the texts. The checklist included 14 content areas related to study skills and learning strategies. These included vocabulary, main ideas and details, reading speed, reading comprehension, critical reading, patterns of organization, note taking, study systems, memory, test taking, content areas, reasoning/problem solving, graphics, and library/dictionary skills.
Study skills are also defined as the ability to acquire, record, organize, synthesize, and remember information (Gettinger & Seibert, 2002). Gettinger and Seibert (2002) identified four clusters of study skills using this definition: repetition or rehearsal-based, procedural or organization-based, cognitive-based, and metacognitive-based. These are described below as cited by Gettinger and Seibert (2002):

• Repetition or Rehearsal-Based skills are the most basic strategies and capitalize on repetition, rehearsal, or re-reading. These are some of the earliest skills learned by children, but tend to be less effective as a student moves through school.

• Procedural or Organization-Based skills include principles of organization, time management, and study routines. Principles that are effective for studying include completing difficult work when you are most alert, dividing long assignments into shorter manageable assignments, varying study tasks, and being flexible in scheduling breaks or rescheduling study time.

• Cognitive-Based skills are designed to make learning meaningful and integrate it into existing knowledge. Students using this strategy effectively activate prior knowledge and use prior knowledge to anchor new knowledge.

• Metacognitive skills relate to how students select, monitor, and use strategies and their ability to choose what and when to use a strategy.

Accordingly, students must realize the need for varied approaches to studying and be able to identify which strategy to use when studying different subject matter.

Wratcher (1991) reported that freshmen face a variety of adjustment issues upon transitioning from high school to college including study skills that are needed for academic achievement. These skills may encompass knowledge base, time management, listening, note taking, test taking, and critical thinking (Wratcher, 1991). Furthermore, college freshmen are expected to be self-directed and must learn to do so in an effective manner. This requires the ability to effectively allocate time across activities, prioritize, organize, determine what to study, attend lectures, integrate information, and seek assistance from faculty when appropriate (Wratcher, 1991).

Again, it is clear that there is a divergence in thinking among professionals not only concerning what skills are most conducive to facilitate learning, but also the breadth of these skills. This may be due to the population of focus, the characteristics of the
learning institution, or the program of research pursued by different authors. However, it is also clear that there is considerable overlap among the features thought to be important for college.

Perhaps the tie that binds these nontraditional academic factors is their focus on self-regulation. According to Webster’s Dictionary (Riverside, 1995), self-regulation is the act of regulating the self or adjusting the self for accurate and correct operation. Simply stated, self-regulation is the student’s ability to control the self or direct the self in an endeavor. Drawing from previous research, Wolters (1998) noted that self-regulated learning is a product of active learners who efficiently manage their own learning experiences and have a variety of cognitive and metacognitive strategies at their disposal for securing success in academic tasks. Research supports the use of self-regulated learning strategies as a successful endeavor in educational settings (Wolters, 1998).

**Time Management**

Britton and Tesser (1991) suggested that self-reports of time management are related to academic achievement and that these effects are independent of SAT scores. However, in summarizing 17 years of research, Lahmers and Zulauf (2000) concluded that the relationship between grades and time management is unclear and at times contradictory. As such, their goal was to investigate the relationship between time spent in academic tasks and performance. Results indicate that the amount of time spent studying is significantly and positively related to performance. To summarize their findings, students spent more time studying as the grades they desired increased; however, to actually realize a letter-grade increase students must increase study time by 40 hours. In addition, for every unit of increased time management there was a .289-point increase in GPA. While this is a small increase, it does establish a link between time management and college performance.

According to Britton and Tesser (1991) differences in time management account for some differences among achievement in college students. Many undergraduates report that their greatest struggle centers around time management (Britton and Tesser, 1991; Wratcher, 1991). Research has typically focused on the effects of different types of time management instruction on stress and behaviors, with the overwhelming results being a change in how time is spent, but not necessarily reduction in stress (Macan,
Macan et al. (1990) attempted to better define time management through creation of a time management measure and to determine the usefulness of time management strategies in the reduction of stress. The results indicate that time management is a multidimensional rather than a unidimensional construct. Four factors were identified under the construct of time management: setting goals and priorities, mechanics such as scheduling and planning, perception of control over time, and preference for organization. The first two factors are typically emphasized when training time management strategies. However, perception of control over time was found to be most related to stress and performance; in other words, do individuals feel empowered to make decisions about how they use their time? In the context of this review, control over time is believed to be highly related to self-regulation. It should be noted that among the studies summarized here, the principle factor of interest was the amount of time spent studying, rather than the quality of the time spent studying.

**Note Taking, Gathering Important Information**

Note taking is related to academic achievement, and the amount of note taking is positively correlated with performance on tests of lecture material (Kiewra, Benton, and Lewis 1985; Baker & Lombardi, 1985). Note taking can also be used as a gauge of listening, engagement, and understanding during learning time and lecture. However, Kiewra et al. (1987) emphasized that note taking (and thus, the information gathered) among college students is generally incomplete. For example, students were more likely to include information presented by the instructor via transparency into their notes regardless of its importance, and only recorded 27% of the additional information identified as important. Students were also more likely to include main ideas and omit details or information that could be reconstructed or inferred (Baker & Lombardi, 1985). In the Kiewra et al. (1987) study, students tended to record broad ideas as opposed to specific detail. However, transcription of broad ideas was generally effective in facilitating recall of specific information, but there is a point of diminishing returns related to length of time between review of notes and the introduction of additional material (Kiewra et al., 1987). The quality and elaborateness of notes and data gathering are positively related to course outcome (Kiewra et al., 1987; Baker and Lombardi, 1985).
Another important self-regulatory strategy is academic engagement. Researchers have found that academic engaged time is related to student achievement (Mercer & Mercer, 2001; Gettinger, 1995). In fact, a causal pathway was found between engagement and achievement in research conducted by Greenwood (1996) and other researchers (Greenwood, Terry, Marquis & Walker, 1994) (as cited in Greenwood, Horton, & Utley, 2002). The majority of research on academic engagement has been conducted with children. Engagement refers to a combination of behaviors that occur in the classroom and include writing, participating in tasks or discussions, reading aloud or silently, and asking questions (Greenwood, Horton, & Utley, 2002). Engaged time is defined as the actual amount of time that a student spends in an activity (Mercer & Mercer, 2001), and can be seen as an extension of time management. According to Gettinger (1995), academic engaged time is a product of three components: allocated time, engagement rate, and success rate. Of these, engagement rate is emphasized in this context. Engagement rate is defined as the proportion of time during which students are learning as evidenced by paying attention, completing problems, and/or interacting with peers (Gettinger, 1995). In the college context, this may also include behaviors related to listening, taking notes, asking questions, or reading materials outside of class.

Interestingly, structural equation modeling research has found that study skills begin to assume a more significant role in achievement as students advance through elementary school and that engagement in the classroom begins to decline in importance as students become more independent learners and complete assignments outside of the classroom (DiPerna, Volpe, & Elliott, 2002). This may also be true for college students; however, this relationship has not been investigated.

It is clear that more research in the area of academic engagement in the college setting is needed. However, drawing from common sense, and perhaps intuitive appeal, it is reasonable to believe that the more time students spend studying, listening, reading, and engaging in the course material, the more likely they are to be successful. This is also likely related to concepts of intrinsic motivation, as previously discussed. Likewise, it is considered a positive skill when a student is a self-advocate for knowledge. Students
who ask questions and volunteer answers in the classroom are expanding their own knowledge, and clarifying information for their personal development.

*Interpersonal Skills and Adjustment*

Elliott and DiPerna (2002) noted that the incorporation of the interpersonal skills construct into the ACES - College (discussed below) was based on its relevance to the original ACES scale, and intuitive appeal. Indeed, Rotheram (1987) indicated that social skills were significantly related to academic competence in school-aged children. Peer relationships may have a more indirect effect on achievement via motivation; motivation is encouraged through peer acceptance, which fosters a love for school and increases students’ willingness to engage and perform well academically (Wentzel & Watkins, 2002).

Wentzel (1993) extended findings cited by Rotheram (1987) and hypothesized that social behaviors are related to many behaviors that are relevant to learning and performance, thus they may also be related to intelligence. In addition, she hypothesized that instructional exchanges between teachers and students may be influenced by teacher preference, which is impacted by social behaviors, or that there may be a direct relationship between academics and social behaviors that is yet unexplained. Based on these hypotheses, Wentzel (1993) researched the extent to which there is a relationship between social and academic outcomes and specifically the extent to which teacher preferences mediate academic performance. To summarize her findings, prosocial behaviors were an independent predictor of academic performance; thus there is a link between interpersonal and social relationships and academic performance, but the nature of this link is not clearly understood.

While some research supports the contention that having friends serve as academic and social resources can have a direct and positive influence on achievement outcomes in school, it is possible that the relationship between social and academic competence may be fundamentally related to self-regulatory capabilities (Wentzel 1991). Schunk (1999) proposed that the progressive internalization of academic norms may be similar to the internalization of social norms, thus academic norms form a type of self-regulation. Specifically, Schunk (1999) proposed a model in which social influences
(environmental variables), achievement outcomes (behaviors), and self-influences (personal variables) are continually interactive.

Although Schunk proposes a somewhat developmental model in which social influences are continual, Wentzel (1991) noted that the relationship between social aspects of development and academics is less emphasized in research with older children. Wratcher (1991) noted that college freshmen face many issues of an interpersonal nature. Specifically, they must adjust to living with new people from varied backgrounds, as well as learn problem solving and decision-making skills required for success in adult life. They may also wrestle with emotional factors related to anxiety, the ability to focus their attention on school matters, and self-regulation. Among the few studies that have investigated the relationship between interpersonal skills and academic achievement, Francis, McDaniel, and Doyle (1987) found support for the contention that role communication training and interpersonal skill building contribute to overall GPA in college students. Thus, while there is scant support for the role of interpersonal skills in the ACES - College version, the exclusion of this category is not entirely warranted and requires additional research.

*Students with a Learning Disability*

The ability to determine what factors are important for success in college becomes even more difficult when considering students who are struggling, and specifically those with learning disabilities. By definition, a student with a learning disability is deficient in at least one area (if not multiple areas) of academic ability. Specifically, students with a learning disability can be expected to show a variety of academic deficits including greater difficulty with reading comprehension and reading rate, difficulties with basic math computation and application, and spelling deficits (Hughes & Smith, 1990). Thus, their traditional academic skills are less well developed than those of students without learning difficulties. In addition to academic deficits, students with a learning disability may display difficulties with distractibility, time management, understanding directions, and interpretation of social cues (Barga, 1996). Therefore, success for the student with a learning disability requires a special set of skills, which may be related to self-regulation.
According to the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV), a learning disability is a disorder usually diagnosed in infancy, childhood, or adolescence (American Psychiatric Association, 1994). While many may carry the diagnosis throughout their academic career, it is clear that for students diagnosed with a learning disability prior to college enrollment, the transition from high school resource situations to college campus can be very difficult even for those who are very bright (Dexter, 1982). Severe learning problems and their related characteristics persist (Buchanan & Wolf, 1986; DSM-IV, 1994) or increase in complexity as children enter adulthood, and become interactive with other variables inherent in that transition (Polloway, Smith, & Patton, 1984; Skinner & Schenck, 1992). Evidence exists to support the pervasiveness of learning disabilities across the lifespan (Gajar, 1992). According to Dexter (1982), the demands of the situations are very different between secondary and post-secondary schools, and may be difficult for the student who is not prepared.

In response to federal legislation, such as Public Law 94-124 (1975) (now known as the Individuals with Disabilities Education Act of 1997) and Section 504 of the Rehabilitation Act (1973), colleges have adopted admissions policies for students with learning disabilities (Skinner & Schenck, 1992). According to Barga (1996), while the implementation of laws protecting the rights of students with a learning disability may have been instrumental in their gaining access to education, students with a learning disability continue to endure negative experiences such as labeling, stigmatization, and gate-keeping. According to Barga (1996), students dealt with these phenomena by using others (benefactors) for support or assistance, employing self-improvement techniques, implementing study skills or self-management strategies, or choosing to forego revealing their disability in lieu of other coping systems (i.e., working harder, cheating, using others, or getting close to the teacher). In short, the student with a learning disability not only faces difficulty with academics, but also faces social and nonacademic challenges that force him/her to adopt coping strategies.

In a review of relevant research, Benz, Fabian, and Nelson (1996) summarized findings indicative that learning and study strategies are not taught at the primary or secondary level, and suggested that this is particularly problematic given the amount of
research supporting the need for students with a learning disability to learn these skills. In fact, students with a learning disability have been found deficient in many, if not most, nonacademic areas related to success in school (i.e., note taking, testing taking, organization, etc.). Thus these students should receive instruction with regard to time management, priority setting, studying, recording lecture material, and reading/note-taking (Dexter, 1982). Instruction in these skills may offset difficulties that students with a learning disability are destined to face.

Differentiating Between Low Achievers and Students with a Learning Disability

Although it is clear that students with a learning disability are at a disadvantage in the college setting, there are other students who struggle as well. Specifically, there is a subset of students who have not been diagnosed as having a learning disability that come to college and struggle. A particular subset of these individuals undergo psychoeducational testing seeking a diagnosis of a Specific Learning Disability, and many get the diagnosis for the first time during late adolescence or early adulthood. According to Hoy and Gregg (1986), since learning disabilities are believed to have selective interference with performance, students may go undiagnosed until college, as they were previously able to handle academic material. Individuals may also manifest a disability during childhood or adolescence, yet go undiagnosed until adulthood (AHEAD, 1997). In fact, according to research cited by Gerber, Schnieders, Paradise, Reiff, Ginsburg, and Popp (1990), and Polloway, Smith, and Patton (1984), learning disabilities are manifested differently across different stages of development, including adulthood.

Dunn (1995) attempted to differentiate between students who had been formally diagnosed with a learning disability, students who self-identified as having a learning disability (unconfirmed), and low achievers. Findings indicated that students with formally diagnosed learning disabilities demonstrated the lowest scores on standardized measures of achievement, but have average or above-average intellectual functioning. Low achieving students had the highest scores on a standardized achievement measure, but had the lowest grade point average. Finally, students who self-reported a learning disability fell between both groups, with math being the area identified as most difficult.
While these studies hold promise for the ability to differentiate between these groups, colleges still do not have reliable indicators. Simply stated, current methods of differentiating between students with a learning disability and low achievers are less than perfect. In fact, Epps, Ysseldyke, and McGue (1984) indicated that access to test battery results (i.e., psychoeducational testing) coupled with standardized criteria for making a diagnosis did not necessarily increase the accuracy of classification among school-based decision-makers.

The ambiguity between these groups has serious implications for college clinics that attempt to identify students with a learning disability in the college population based only on self-identification and psychoeducational measurement. In 1996, Boston University argued against the provision of accommodations for students with learning disabilities, claiming that the legitimacy of their diagnoses had not been established (Guckenberger v. Boston University, 1997). Thus the central issue in this case was the ability to determine who had a legitimate disability (Siegel, 1999). According to Siegel (1999), all postsecondary institutions must determine which students may receive accommodations based on the presence of a learning disability; however, clear criteria for making this determination were rarely available.

The Association on Higher Education and Disability (AHEAD) developed guidelines for determining a learning disability in response to this dilemma (1997). The guidelines developed by AHEAD stress the need for qualified evaluators, recent documentation, documentation to substantiate a disability, and evidence supporting the need for accommodations (1997). Of paramount importance in distinguishing students with a learning disability from students without a learning disability and low achieving students based on the AHEAD criteria is history of academic difficulty. In other words, there must be an established history of academic difficulty that is pervasive throughout their academic career. While these criteria have been useful, they have not eliminated the ambiguity of the diagnosis.

Given that the line of distinction between students with a learning disability and low achieving groups is difficult to determine, Algozzine, Ysseldyke, and McGue (1995) argued that the designation of a learning disability may either be nothing more than a way of dealing with a specific subclass of low achievers, or it may be a legitimate category
that needs more accurate measures. These particular researchers resonate with the findings of Epps et al. (1984), in that learning disabilities cannot be differentiated from low achievement based on psychometrics alone. Furthermore, while students with a learning disability may be a group of the lowest of the low achievers, Algozzine et al (1995) argue that students with a learning disability do not necessarily have qualitatively different needs from other students who are struggling. What can be said with some assurance is that students with a learning disability sometimes perform lower than low achieving students (Algozzine et. al, 1995).

Measuring Academic Competence

It is relatively safe to say that there are a number of factors that contribute to success in college. Those factors deemed to be important vary between research programs; however, the current line of research indicates that academic skills and self-regulatory behaviors/study skills (i.e., motivation, study skills, and academic engagement) are among the most important variables that translate into academic success for regular and students with a learning disability. Several measures have been created that purport to measure aspects of academic competence (as it is defined here). Two of these measures are considered here.

Development and Evaluation of the Academic Competence Evaluation Scales (ACES)–College

In 1999, DiPerna and Elliott set out to clarify and operationalize the definition of competence and begin development of an instrument to measure it. Specifically, they sought to identify skills, attitudes, and behaviors of learners that contribute to teacher judgements of academic performance at the primary school level (DiPerna & Elliott, 1999). The authors conducted the analysis using 56 elementary school teachers and their ratings for 300 students, 30 of which were learning disabled. They predicted that learner-controlled components (study skills, motivation, interpersonal skills, etc.) would contribute to academic competence, and that teacher ratings of student competence would
be positively related to student test scores and social skills, and negatively related to problem behaviors. Measures of social skills and problem behaviors were used for convergent and discriminant analysis, respectively. In addition, the Social Skills Rating System – Teacher Form (SSRS-T) (1990) and the Iowa Test of Basic Skills (ITBS) (1993) were administered.

Based on this study, DiPerna and Elliott (1999) found five factors that accounted for 72% of the variance in the total scale of the ACES (K-5) and yielded a rotated factor solution consisting of academic skills, interpersonal skills, academic motivation, participation (engagement), and study skills. Correlations between the ACES (K-5) and the ITBS ranged from low to high, but most were modest, with the academic skills scale showing the highest correlation. All scales but the interpersonal scale demonstrated high positive correlations with the competence scale on the SSRS, while the interpersonal scale correlated moderately. The academic scale correlated highest with the competence subscale on the SSRS. All ACES (K-5) scales demonstrated moderate to large correlations with social skills ratings on the SSRS, with interpersonal skills demonstrating the highest. No relationship was noted between academic skills and problem behaviors; however, moderate to high negative correlations between problem behaviors and the four other scales was noted with the highest between interpersonal and problem behavior.

Two additional ACES instruments were developed from this line of research, namely the grades six-12 version and the college version. The college version is an upward extension of the ACES student version for grades six-12; however, both were developed based on the original teacher version (DiPerna & Elliott, 2000). These additional measures are similar to the K-5 measure; however, teacher ratings are less important, and students are asked to provide self-ratings of their academic competence. According to DiPerna and Elliott (2000), the ACES model (for the K-5, 6-12, and college versions) divides academic competence into two constructs that encompass all the skills, attitudes, and behaviors related to success in college. These scales are the academic skills and academic enablers scales. The academic skills scale is associated with skills such as reading, writing, math, and critical thinking. The academic enablers scale encompasses
the attitudes and behaviors that allow a student to benefit from instruction, and encompass the additional four factors identified in their 1999 study.

While the academic skills scale is somewhat straightforward, the academic enablers scale is more complex. According to DiPerna’s and Elliott’s model (2000), the academic enablers scale consists of motivation, study skills, engagement, and interpersonal skills. Following are brief descriptions of the scales (DiPerna & Elliott, 2000):

- **Motivation scale**: measures a student’s initiative and persistence in academic subjects and includes items assessing responsibility, preference for challenging tasks, and goal-directed behaviors.
- **Study skills scale**: related to behaviors and skills that facilitate learning new information and includes work preparation, work completion, and work review.
- **Engagement scale**: assesses the level of active participation during class and reflects asking questions, volunteering answers, and assuming leadership.
- **Interpersonal scale**: measures communication and cooperative behaviors needed to interact with other students. It is composed of social interaction, work interaction, and responsive behavior.

To summarize, the purpose of the development of the ACES – College was to identify skills, attitudes, and behaviors of learners that contribute to academic performance at the post secondary school level. As previously stated, there is little debate regarding the importance of academic skills; however, nonacademic skills of importance are very broad in scope. The ACES emphasizes four nontraditional academic skills, three of which (motivation, study skills, and engagement) are highly related to academic self-regulation, and one related to interpersonal skills.

In terms of its psychometric properties, research was conducted using the standardization sample. The sample consisted of 250 participants, approximately 32% of which were derived from two-year colleges and 68% were derived from four-year universities. Two percent of the sample self-reported a previously diagnosed Specific Learning Disability. Statistical analysis indicated that the ACES – College has a coefficient alpha of .96 and .94 for the Academic Skills Total and Academic Enablers Total, respectively (Elliott & DiPerna, 2002). Individual subscales range from a low of
.82 (Interpersonal Skills scale) to a high of .93 (Critical Thinking). In terms of test-retest reliability, the ACES – College demonstrated reliability scores of .97 for the Academic Skills Total and .94 for the Academic Enabler’s Total. The individual subscales ranged from a high of .94 (Critical Thinking) to a low of .77 (Interpersonal Skills).

In a study designed to evaluate the criterion validity of the ACES - College, Elliott and DiPerna (2002) examined the relationship between scores on the ACES to GPA, SAT, or ACT scores, as well as the ability of ACES scores to differentiate between self-reported students with a learning disability and students who did not report a learning disability. The study employed the standardization sample from the manual (n=250), of whom 31 indicated that they had been identified as having a Specific Learning Disability in high school or earlier (it should be noted that this was self-reported and not verified for accuracy or diagnostic criteria). Overall GPA was weakly to moderately correlated with both the academic skills total (r= .26) and the academic enablers total (r= .31). A similar relationship was found between last semester GPA and the Academic Skills Total (r= .22) and the Academic Enablers Total (r= .38). In terms of individual subscales on the Academic Enablers scale, the highest correlation was between overall GPA and study skills (r= .29) and the lowest was with interpersonal skills (r= .01). In terms of SAT/ACT scores low to moderate relationships (r= .01 - .47) were noted between these measures and each of the scales on the ACES, with the strongest relationships being manifested between the Academic Skills and College Entrance scores. The Interpersonal Skills subscale was negatively correlated with both measures (r= -.01 to -.13).

In terms of differentiating between students with a learning disability and students without a learning disability, Elliott and DiPerna (2002) contend that the ACES is a useful instrument for differentiating between these groups of students. Statistically significant lower scores were noted for students with a learning disability on the academic skills cluster, however, no differences were found between groups on the enablers scale. This is somewhat surprising given that students with a learning disability have also been found to be deficient in these areas. However, Ley and Young (1998) noted that when asking under prepared students to report on self-regulated learning strategies it is likely that the results are skewed. In other words, these learners may be only vaguely aware of learning processes, and when asked to report on the frequency of
strategy use, may over-report frequency (Ley & Young, 1998). However, using a discriminant function analysis, 76% (r and $r^2$ not provided) of students were correctly classified as having or not having a learning disability, thus indicating that the ACES may be a useful tool for differentiating between groups (Elliott & DiPerna, 2002).

While these findings are useful and bode well for the ACES, Elliott and DiPerna (2002) noted several caveats. For example, correlations between grade point averages and the ACES were lower than expected when compared to the K-12 data; however, the authors stated that this may be an artifact of the selectivity of the sample (college students are expected to have a certain level of aptitude at the outset). Furthermore grade point average data was self-reported rather than verified, thus students could have misreported this information. The interpersonal skills subscale was virtually unrelated to any of the validity measures administered; however it was maintained in the analysis due to intuitive appeal and its relationship to the original instrument.

One important caveat pertained to the inclusion of students with a Specific Learning Disability. Specifically, the legitimacy of the diagnosis could not be verified (Elliott & DiPerna, 2002). Furthermore, these students reported having been diagnosed with a learning disability in the past. Thus, these students may have had enough experience with post secondary education to have acquired adaptive skills. Likewise, these students were not necessarily identified as struggling in college. Therefore, the ability of the ACES – College to accurately discriminate between self-referred learning disabled, non-learning disabled, and low achieving students is not sufficiently established; however, this is not the sole purpose of the inventory.

In 2004, DiPerna attempted to investigate both the structural and concurrent validity of the ACES – College using Factory Analysis and simple correlation. Specifically, 414 college students from various colleges and universities across the United States completed the ACES. Two Exploratory Factor Analysis procedures were conducted to determine the factor structure of the Academic Skills and Academic Enablers subscales. Three Academic Skills factors were identified, accounting for 59.87% of the total scale variance, and each item retained for the respective identified scales had factor pattern coefficients of .40 or greater. Those items for which multiple loadings were indicated, were assigned to the factor that seemed intuitively appropriate,
despite their loadings. Four to six factors were identified for the Enablers scale; however, review of orthogonally rotated three, four, and five-factor solutions indicated a four-factor solution was most appropriate (45.29% of variance). Again, items for each scale demonstrate pattern coefficients of .40 or greater; however, two items were shifted between scales due to intuitive appeal. Thus, DiPerna concluded that the underlying factor structure of the ACES originally identified for the K-12 version, continued to emerge for the College version. However, intuitive item assignment when multiple loadings for specific items were found, calls into question the integrity of the scales that were retained.

DiPerna (2004) also sought to explore the relationship between scores on the ACES and college GPA. Specifically, the ACES scales and subscales were hypothesized to be low to moderately correlated with cumulative GPA, as well as current semester GPA. Consistent with his hypothesis, correlations between ACES scales and subscales and cumulative GPA demonstrated low (Interpersonal Skills $r^2 = .01$) to moderate correlations (Academic Skills Total $r^2 = .38$). However, the correlation between cumulative GPA and the Interpersonal Skills and Engagement subdomains was not statistically significant at the 0.05 alpha level, indicating no significant relationship between student performance in these domains and sustained academic performance. Similarly, low (Interpersonal Skills $r^2 = .20$) to moderate (Academic Enablers Total $r^2 = .47$) correlations were found between ACES scores and last semester GPA. Again, Interpersonal Skills did not demonstrate a statistically significant relationship with GPA at the 0.05 alpha level. Summarily, DiPerna’s findings suggest that the ACES is only moderately related to student grade performance. Furthermore, the Engagement subdomain is of less importance when considering sustained performance. Additionally, although the Enablers Total scale score demonstrated a stronger correlation with GPA when considering short-term performance, overall Academic Skills demonstrated a slightly higher correlation with GPA when considering sustained performance. Finally, the Interpersonal Skills subdomain continued to have virtually no relationship to college grade performance.
The Learning and Study Strategies Inventory was developed by Weinstein (1987) to measure both cognitive and affective aspects of academic competence in college students. It also has a downward extension of the scale that is used for high school students. Specifically, the LASSI has 10 scales, five for affective issues and five for cognitive issues. Scores on the LASSI are translated into percentiles, which allow the individual to be compared to performance in the norm group. The norm group was comprised of 780 incoming freshmen.

In terms of psychometric properties of the scale, the LASSI has an overall test-retest correlation of .88 at three to four week intervals; however, individual subscales vary in terms of reliability from a low of .72 on the information processing scale to a high of .85 on the time management and concentration subscales. Coefficient alphas range from .68 (study aids) to .86 (time management).

The most current version of the LASSI has 10 separate scales including: attitude, motivation, time management, anxiety, concentration, information processing, selecting main ideas, study aids, self-testing, and test strategies. Essentially, the LASSI has attempted to break apart many aspects of the motivation research into measurable subskills. For example, the attitude and motivation scales can be seen as measuring similar behaviors. As well, many of the broad topics discussed above have been partitioned into scaled scores on the LASSI. Each scale is briefly described below:

- **Attitude:** This scale measures students’ general attitude toward school and specifically, their overarching attitude toward school success. It is also seen as a measure of goal-direction in terms of how attending college will fulfill life goals.
- **Motivation:** The motivation scale is a partner to the attitude scale, which measures a student’s willingness to engage in everyday tasks related to success in college (e.g., reading textbooks, preparing for class, etc.). It is also seen as a measure of one’s willingness to take personal responsibility for learning.
Time Management: Time management relates to one’s ability to adequately allocate their time to each of the tasks required for college performance and to prioritize one’s tasks and time. Specifically, this is related to the ability to schedule, work against procrastination, and ignore competing activities that interfere with studying.

Anxiety: This scale measures one’s tension or anxiety about completing academic tasks, as manifested by the tendency to have negative thoughts about one’s abilities.

Concentration: The concentration scale measures a student’s capacity to focus their attention on school and school related-tasks and ignore thoughts, emotions, or situations which compete for their attention.

Information Processing: This scale measures the extent to which students use elaboration and organizational strategies to attach new information to prior knowledge and make information personally meaningful. It is similar to using cognitive schema to organize information.

Selecting Main Ideas: This scale measures a student’s ability to separate important information from that which is redundant or superfluous.

Study Aids: This measures the student’s ability to not only recognize how text organization aids in understanding information, but also to create their own study guides using these strategies.

Self-Testing: Self-testing is a metacognitive strategy in which a student checks out his/her own knowledge to ascertain their level of understanding. This provides a way for the student to know how much information they have actually acquired versus how much they need to continue to acquire.

Test Strategies: This scale refers to one’s ability to prepare for different types of tests and create effective strategies for test taking.

Although Weinstein cautioned against the use of a composite score, there is some evidence of an underlying factor structure for the scale. Specifically, in 1992, Olejnik and Nist conducted exploratory and confirmatory factor analyses on the 10 scales of the LASSI, and a three-factor solution was derived. The first factor, effort-related activities, consisted of motivation, time management, and concentration, with the highest correlation associated with time management. The second factor, goal orientation, included anxiety, test strategies, and selecting main ideas; it was most correlated with test
strategies. Finally, the third factor, cognitive activities, included information processing, study aides, and self-testing; the highest correlation was with self-testing. Among the latent variables, the strongest relationship was obtained between effort-related activities and cognitive activities. Attitude loaded on all factors, but was consistently low.

In 1998, Olaussen and Braten attempted to validate the three-factor model using a culturally different sample. Their study yielded a similar factor structure, with minor differences. Specifically, Attitude was subsumed under the effort-related activities factor and had moderate correlations with goal orientation, but no relationship with cognitive activities. Finally, effort-related activities and cognitive activities remained correlated, but negative correlations were obtained between these factors and goal orientation.

Melancon (2002) attempted to investigate the reliability, structure, and criterion validity of the LASSI. Two of her three research questions are of particular interest here. Namely, what are the coefficient alphas for each scale, and can the LASSI be factor-analyzed into discrete subscales? Coefficient alphas obtained for this study approached those reported in the manual, lending evidence for its internal stability. In terms of underlying structure, the 10 traditional scales utilized by the LASSI did not clearly emerge. In fact, 18 possible factors were identified, however, fewer than 10 are being adequately assessed. According to Melancon, this casts some doubt on the utility of the 10 scales and suggests that fewer scales may be desirable and psychometrically superior.

In 1990, Nist, Mealey, Simpson, and Kroc used the LASSI to measure affective and cognitive growth of both regularly admitted and developmental students (students identified as struggling who were mandated to enroll in a study skills course) after participating in an eight-week study skills course. The purpose of the study was not only to measure how sensitive the LASSI was in detecting growth or change, but also to see how well the LASSI could predict grades in each group of students. In sum, the LASSI did an effective job of measuring growth or change for both groups, indicating that the LASSI is sufficiently sensitive for use as a pre-post instrument. However, in terms of predictive capability, the LASSI fell somewhat short. For the regular students, the LASSI was predictive of GPA in regular courses. The LASSI was able to account for 20% of the variance in GPA for this group, with motivation encompassing the lion’s share of the explained variance (16%). In contrast, for the developmental students, no
scale or combination of scales on the LASSI was predictive of college GPA; however, some correlation was found between GPA, time management, and concentration. Based on these findings, it appeared that the LASSI may be less appropriate for measuring performance among developmental students.

In 1994, Denning, Valeri-Gold, and Idelman conducted a study to assess the reliability and validity of the LASSI for use with developmental students (defined in this study as students with SAT composite scores below 320), particularly since the norming group for the LASSI did not include developmental students. In terms of psychometrics of the scale, the authors found that coefficient alphas for each subtest approached, but did not match those reported by Weinstein, and that none of the subtest coefficients were of the same magnitude of those obtained by Weinstein. Furthermore, when using the manual’s suggested cutoff of students at the 75th percentile for determining the need for additional assistance, it is assumed that all developmental students would score below this point. In contrast to what might have been predicted, developmental students scored significantly better than expected on attitude, time management, and self-testing, as expected on measures of motivation, concentration, information processing, and test strategies, and worse than expected in terms of anxiety, selecting main ideas, and study aids. Similar to Nist et al. (1990), the authors cite these findings as evidence that the LASSI may be inappropriate for predicting the performance of developmental students.

Haynes, Comer, Hamilton-Lee, Boger, and Joyner (1987) conducted a study to investigate the LASSI’s ability to differentiate between low, average, and high achieving high school students. Their results indicated that the low achieving group differed significantly from the average and high achieving group, but it was not possible to distinguish between the average and high achieving groups using the LASSI. In terms of the scales’ ability to classify students into one of the three groups, only the motivation, selecting main ideas, and time management subscales contributed significantly to the discriminant function analysis. Of these three scales, motivation was the best discriminator.

Overall, there is some concern regarding the current uses of the LASSI, not only in terms of the population for which it is being used, but also in terms of its scale structure and interpretation. No doubt, additional studies have been called for since the
development of the scale, and continue to be needed. This calls into question the usefulness of the scale; however, the populations on which these studies were conducted consisted of dichotomous samples of regular and developmental students. It may be that further differentiation of the developmental group could provide additional information regarding the utility of the LASSI.

Conclusion

Academic competence has been coined as a term that describes both the academic skills and behaviors necessary to achieve success in college. Traditional measures such as college entrance exam scores and grade point average may not provide full assessments of competence, and have limited utility past the first year of enrollment. Furthermore, traditional measures may overestimate student performance in college, resulting ultimately in higher rates of attrition and/or students seeking additional support through disability resource centers on campus. Based on the short-comings of traditional measures of achievement, some researchers advocate for broader assessments that include study skills or college preparedness. However, the importance of study skills, as well as the study skills that comprise academic competence, is not universally defined.

Two instruments that have been identified as measures of competence include the ACES – College (DiPerna & Elliott, 2001) and the LASSI (Weinstein, 1987). Preliminary research involving the ACES is promising, indicating that it is not only moderately correlated with GPA, but also able to distinguish between achieving and non-achieving college students (with learning disabilities). In contrast, research with the LASSI is questionable, and contains criticisms regarding its use with struggling college students as well as its scale structure.

It is accepted that college students with learning disabilities and college students who have low achievement profiles will differ from regularly achieving college students in terms of academic performance. However, somewhat less is known regarding the differences between these groups in terms of academic or study behaviors. There is also a need to have a greater understanding of the information the ACES and LASSI yield regarding differences between achievement groups, as well as the degree of overlap in
terms of the data that these instruments provide. Finally, there is a need to investigate the
degree to which data from these instruments can increase the predictive ability of
traditional academic measures. Summarily, what are the statistical and practical
implications for the ACES and the LASSI?
CHAPTER THREE
Methodology

Statement of Hypotheses Based on Original Research Questions

Based on the original research questions posed in chapter one and the information obtained through the review of literature in chapter two, the following research hypotheses were offered:

1. **There is no relationship between group membership and scores on the ACES (Null).**
   
   The prediction is that the three groups of interest (learning disability, low-achieving, and comparison) do not differ in terms of scores on the ACES.

2. **There is no relationship between group membership and scores on the LASSI (Null).**
   
   The prediction is that the three groups of interest (learning disability, low-achieving, and comparison) do not differ in terms of scores on the LASSI.

3. **There is no relationship between scores on the LASSI and the ACES (Null).**
   
   The prediction is that the LASSI subscales do not be correlated with each of the subscales on the ACES.

4. **There is no relationship between high school academic GPA, college entrance exam scores (SAT, ACT, or CPT), LD status, and total scores on the ACES in terms of predicting semester GPA (Null).**
   
   It is assumed that scores on the ACES, coupled with information regarding high school GPA, college entrance exam scores, and LD status, are not able to predict performance in college as measured by semester GPA.

5. **There is no relationship between high school academic GPA, college entrance exam scores (SAT, ACT, or CPT), LD status, and scores on the LASSI in terms of predicting semester GPA (Null).**
   
   It is assumed that scores on the LASSI, coupled with information regarding high school GPA, college entrance exam scores, and LD status, are not able to predict performance in college as measured by semester GPA.
6. There is no relationship between high school academic GPA, college entrance exam scores (SAT, ACT, or CPT), LD status, scores on the LASSI, and scores on the ACES in terms of predicting semester GPA.

It is assumed that scores on the ACES and LASSI (jointly), coupled with information regarding high school GPA, college entrance exam scores, and LD status, are not able to predict performance in college as measured by semester GPA.

**Variables**

**Hypothesis 1:**
- **Independent Variables:** Group (learning disability, low achieving, comparison).
- **Dependent Variables:** Academic Subscale Scores and Total Scores (nine scores).

**Hypothesis 2:**
- **Independent Variables:** Group (learning disability, low achieving, comparison).
- **Dependent Variables:** LASSI Subscale Scores (10 scores).

**Hypothesis 3:**
- **Correlates:**
  - **ACES:** Academic Skills Total, Reading/Writing Skills, Math/Science Skills, Critical Thinking Skills, Academic Enablers Total, Interpersonal Skills, Engagement, Motivation, and Study Skills.
  - **LASSI:** Anxiety, Attitude, Motivation, Time Management, Information Processing, Selecting Main Ideas, Self-Testing, Test Strategies, Concentration, and Support Techniques.

**Hypothesis 4:**
- **Predictor Variables:** Estimated high school academic GPA, college entrance exam scores (SAT, ACT, or CPT), group membership (learning disability, low achieving, and comparison), ACES Academic Skills Total, and ACES Academic Enablers Total.
- **Criterion Variable:** Semester GPA
Hypothesis 5:

Predictor Variables: Estimated high school academic GPA, college entrance exam scores (SAT, ACT, or CPT), group membership (learning disability, low achieving, and comparison), Anxiety, Attitude, Motivation, Time Management, Information Processing, Selecting Main Ideas, Self-Testing, Test Strategies, Concentration, and Support Techniques (raw scores).

Criterion Variable: Semester GPA

Hypothesis 6:

Predictor Variables: Estimated high school academic GPA, college entrance exam scores (SAT, ACT, or CPT), group membership (learning disability, low achievement, and comparison group), Anxiety, Attitude, Motivation, Time Management, Information Processing, Selecting Main Ideas, Self-Testing, Test Strategies, Concentration, Support Techniques (raw scores), Academic Skills Total, and Academic Enablers Total.

Criterion Variable: Semester GPA

Procedures

The Adult Learning Evaluation Center is a diagnostic and service-oriented center located on the campus of Florida State University. It is a part of the College of Education and employs graduate students who are being trained to become school psychologists. This particular clinic serves adult and college-aged clientele who are struggling with college-level curriculum. Clients may self-refer or receive a referral from outside agencies or their respective educational institution at which they are attending. The primary goal of the center is to administer psychoeducational evaluations as a means of determining if a student has a Specific Learning Disability and/or Attention-Deficit/Hyperactivity Disorder. Additionally, the center offers services such as study skills workshops and ADHD coaching.

Prior to evaluation, each student who is referred to ALEC is required to complete an application form. The application form gives demographic information, as well as information regarding academic history, nature of academic difficulty, health history, and
psychological functioning (specifically with regard to depression, anxiety, and ADHD). The application is reviewed by the clinical director prior to scheduling an evaluation; it is later reviewed by the examiner during an interview to insure accuracy and provide additional information regarding the nature of academic difficulty. Immediately before beginning the evaluation, each client is asked to complete an informed consent; the consent allows the evaluation to be conducted and gives the client the opportunity to participate in on-going research at the clinic.

The psychoeducational evaluation consists of the Wechsler Adult Intelligence Scale, Third Edition, selected subtests from the Woodcock Johnson III Tests of Cognitive Abilities and Tests of Achievement, and the Learning and Study Strategies Inventory (LASSI). For each client, the following information is obtained from the WAIS III: Full Scale IQ, Verbal IQ, Performance IQ, Verbal Comprehension Index, and Perceptual Organization Index. The following information is obtained from the WJ III COG: Comprehension-Knowledge cluster, Long-Term Retrieval cluster, Visual-Spatial Thinking cluster, Auditory Processing cluster, Fluid Reasoning cluster, Processing Speed cluster, Short-Term Memory cluster, Phonemic Awareness cluster, Working Memory cluster, and Broad Attention cluster. The following information is obtained from the WJ III ACH: Broad Reading, Basic Reading Skills, Broad Math, Broad Written Language, Oral Language, and Phoneme-Grapheme Knowledge. Ten individual scores on the LASSI are also collected. Criteria as set forth by the Association of Higher Education And Disability (AHEAD, 1997) are used for diagnosis. Specifically, a student must demonstrate a history of academic difficulty, intelligence that is at least in the average range, a one standard deviation discrepancy between an achievement area and intelligence score, and a one standard deviation discrepancy between a cognitive cluster and intelligence score. Students who meet this criterion are formally diagnosed according to the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV; APA, 1994). Information from the LASSI is not used for formal diagnosis; rather, it is utilized to determine whether a student employs effective study strategies that are conducive to learning in the college setting. All of the obtained information is incorporated into a comprehensive psychoeducational report and each student is given feedback regarding their performance.
For the purpose of this investigation, the above procedures were used to obtain participants and classify them into one of two criterion groups: students with Specific Learning Disabilities or Low Achieving (without a diagnosed disability). In addition, clients were asked to sign a supplementary consent to participate in this study. If they consented, they were given the ACES – College prior to being evaluated and were entered into a lottery for $100.00. A separate write-up was offered explaining the results of the ACES (as an addendum to their comprehensive psychoeducational report). Additional recommendations were offered as well.

Participants for the comparison group were drawn from courses taught in the College of Education. Comparison group participants also met the following minimum criteria: a GPA of 2.5 or higher and no history of learning difficulties or attention problems. Students from each course were approached during regular class hours and participation was solicited. Students who were interested in participating in the study were asked to complete an assessment packet at the conclusion of class or to bring the completed packet to a subsequent class meeting containing the following information: a consent form, a demographic form, the LASSI, the ACES, and three likert-scored items related to level of effort expended in college and level of perceived difficulty. In addition to estimating their current grades, students were asked to report their academic high school grade point average, college grade point average, and college entrance exam score (SAT, ACT, or CPT), and were asked for permission to access their end of semester grade point average from the University database. Students who returned their packet within two weeks were entered into a separate lottery drawing for $100.00. Each student was given a report and offered individual feedback regarding their performance on the two scales. Only data from those students who had a self-reported grade point average of at least 2.5 and no self-reported diagnosis of a learning disability or ADHD were utilized.
Elliott and DiPerna (1999) coined the term “academic competence” to explain the set of skills and behaviors that coincide with academic success. Specifically, academic competence includes both the knowledge or skills base for success (reading, writing, math, science, and critical thinking), as well as task approach behaviors or “study skills” needed to sustain performance over time. In 2001, Elliott and DiPerna constructed the college version of the Academic Competence Evaluation Scales (ACES) as a means of measuring individual academic competence in post secondary students. In addition to representing the construct of competence, this instrument purports to differentiate students with learning disabilities from normal or “regular” college students. The Learning and Study Strategies Inventory (LASSI) (Weinstein, 1987) was also created as a measure of “competence”, and was specifically designed to assess both the behavioral and affective strategies associated with success in college. The original purpose of this study was to analyze the utility of these two measures of academic competence and answer the following general questions:

1. If both the ACES and the LASSI measure academic competence, how well do they discriminate between students with and without learning problems?
2. Can these instruments be used to classify students into categorical groups?
3. What is the strength of relationship between the ACES and LASSI?
4. Do these instruments add to the predictive ability of high school grade point averages, college entrance exam scores, and group membership when examining college performance? Essentially, using this information, can we improve the prediction of how a student will perform in college based on additional information provided by the LASSI and the ACES?
The sample for this study consisted of 207 college (18 or older) students from local colleges and universities in North Florida and South Georgia. Participants were obtained according to the procedures outlined in chapter three. Students were divided into three criterion groups: learning disability, low achieving, and comparison group (no learning difficulties): Comparison group (n=104), Low-Achieving group (n=39), and Learning Disability group (n=64). Demographics for this overall sample are reported in Table 4-1. Students with Learning Disabilities and students from the low achieving group were college students who self-referred to the Adult Learning Evaluation Center to investigate the possibility that a Specific Learning Disability was contributing to current academic difficulty. Each student was evaluated for the presence of a specific learning disability (described in chapter three). At the conclusion of the evaluation, using established criteria (see procedures), these students were classified as having a learning disability or low achieving and were assigned to their respective groups. Students in the comparison group were obtained from an undergraduate course taught by the College of Education, reporting a GPA above 2.5 who have not been diagnosed with a learning disability or Attention-Deficit/Hyperactivity Disorder.

Briefly, the sample consisted of 30% male and 70% female participants. The majority of the sample was seniors (33.8%), followed by sophomores (28.5%), juniors (26.1%), and freshmen (11.6%), respectively. Participants ranged in age from 18 to 56, with a mean age of 24 years. One hundred thirty three participants were drawn from Florida State University (64.7%), 60 were drawn from Tallahassee Community College (28.5%), and the remaining 14 (6.7%) were drawn from various local colleges and universities (i.e., Florida A&M University, Valdosta State University, etc.). For those participants recruited through the Adult Learning Evaluation Center, 31.9% were referred for psychoeducational testing due to problems in mathematics, 10.6% were referred for a combination of academic difficulty (i.e., not limited to a single subject area or related to difficulties passing the CLAST exam), 4.8% were referred for difficulties with reading, 1.9% were referred for nontraditional academic difficulty (i.e., foreign language), and less than one percent (0.5%) were referred for difficulties with written language.
Table 4-1 *Demographic Characteristics of the Sample (N=207)*

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<th>Number of Participants</th>
<th>Percentage</th>
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</tbody>
</table>
As seen in Table 4-2, the majority of the LD sample was comprised of males (n=31), while the majority of the comparison group was comprised of females (n=86). The entire comparison group was drawn from Florida State (n=104); in contrast the majority of the Low Achieving group was drawn from Tallahassee Community College (n=25). Students with LD were drawn in approximately equal amounts from both schools (n=21 FSU; n=34 TCC). A large portion of the LD and LA groups were comprised of freshmen and sophomores (n=75); in contrast, a large portion of the comparison group consisted of juniors and seniors (n=96). Thirty-nine of the group that self-referred for math difficulties at ALEC were actually diagnosed with a learning disability, whereas 27 of the individuals that self-referred for math difficulties did not receive a formal diagnosis. In addition, for the LD group, 15 presented with multiple learning disabilities, eight were diagnosed with a reading disability, and two were received diagnoses that were based on referrals for difficulties with the CLAST or difficulties with foreign language. With regard to the Low Achievement group, seven self-referred for multiple difficulties, two self-referred for difficulties with reading, two self-referred for “nontraditional” reasons, and only one self-referred for difficulties with writing tasks. Please refer to Table 4-2.

Table 4-2 Demographic Characteristics of the Sample by Group (N=207)

<table>
<thead>
<tr>
<th>Variable</th>
<th>LD n=64</th>
<th>LA n=39</th>
<th>Comparison n=104</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>31</td>
<td>13</td>
<td>18</td>
</tr>
<tr>
<td>Female</td>
<td>33</td>
<td>26</td>
<td>86</td>
</tr>
<tr>
<td>School</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Florida State</td>
<td>21</td>
<td>9</td>
<td>104</td>
</tr>
<tr>
<td>Tall. Comm. College</td>
<td>34</td>
<td>25</td>
<td>0</td>
</tr>
<tr>
<td>Other</td>
<td>9</td>
<td>5</td>
<td>0</td>
</tr>
</tbody>
</table>
Three additional ratings of perceived effort, difficulty, and performance were obtained from comparison group students; a likert scale rating ranging from one to five was employed for each category. Less than one percent of those surveyed perceived their classes to be “very difficult” and approximately 1.7% perceived their classes to be “not difficult at all”; the median response was that classes were “occasionally” difficult, as reported by 28.2% of students. Approximately 11.9% of comparison students indicated that they were performing “far above average” academically, while less than one percent indicated that they were “failing”. The median performance response indicated that 33.3% of all students rated their performance as falling in the “average” range. Finally, 6.8% of comparison students reported expending “very much effort” into maintaining their performance, while less than one percent reported expending “no effort at all.” The median effort response indicated that 26.6% of comparison students felt that they put “a lot of effort” into their studies.

Results of Data Analyses

The means and standard deviations of all variables of interest are presented in Table 4-3.

<table>
<thead>
<tr>
<th>College Rank</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Freshman</td>
<td>14</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>Sophomore</td>
<td>30</td>
<td>23</td>
<td>6</td>
</tr>
<tr>
<td>Junior</td>
<td>6</td>
<td>2</td>
<td>46</td>
</tr>
<tr>
<td>Senior</td>
<td>14</td>
<td>6</td>
<td>50</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Referral Problem</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Math</td>
<td>39</td>
<td>27</td>
<td>0</td>
</tr>
<tr>
<td>Combination</td>
<td>15</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>Reading</td>
<td>8</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Nontraditional</td>
<td>2</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Writing</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Variable</td>
<td>LD Group</td>
<td>LA Group</td>
<td>Comparison</td>
</tr>
<tr>
<td>---------------------------</td>
<td>-------------------</td>
<td>-------------------</td>
<td>------------------</td>
</tr>
<tr>
<td></td>
<td>M (SD) N=64</td>
<td>M (SD) N=39</td>
<td>M (SD) N=104</td>
</tr>
<tr>
<td>Prior Cum. GPA</td>
<td>2.67 (0.58)</td>
<td>2.48 (0.56)</td>
<td>3.33 (0.44)</td>
</tr>
<tr>
<td>Current GPA</td>
<td>2.54 (0.88)</td>
<td>2.06 (1.07)</td>
<td>3.43 (0.51)</td>
</tr>
<tr>
<td><strong>ACES</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Academic Skills</td>
<td>90.05 (13.88)</td>
<td>85.72 (17.47)</td>
<td>111.93 (15.88)</td>
</tr>
<tr>
<td>Reading/ Writing</td>
<td>32.91 (7.82)</td>
<td>31.08 (7.30)</td>
<td>38.15 (6.03)</td>
</tr>
<tr>
<td>Math/ Science</td>
<td>23.63 (6.95)</td>
<td>22.92 (7.05)</td>
<td>34.99 (7.20)</td>
</tr>
<tr>
<td>Critical Thinking</td>
<td>33.47 (6.06)</td>
<td>31.46 (6.75)</td>
<td>38.85 (6.16)</td>
</tr>
<tr>
<td>Enablers</td>
<td>143.47 (18.73)</td>
<td>142.72 (18.30)</td>
<td>149.41 (15.44)</td>
</tr>
<tr>
<td>Interpersonal</td>
<td>33.56 (4.49)</td>
<td>34.08 (4.25)</td>
<td>34.27 (3.94)</td>
</tr>
<tr>
<td>Engagement</td>
<td>30.13 (5.60)</td>
<td>27.90 (5.80)</td>
<td>30.39 (5.64)</td>
</tr>
<tr>
<td>Motivation</td>
<td>39.52 (6.31)</td>
<td>39.18 (6.60)</td>
<td>41.09 (5.94)</td>
</tr>
<tr>
<td>Study Skills</td>
<td>40.38 (6.63)</td>
<td>41.56 (6.58)</td>
<td>43.45 (4.92)</td>
</tr>
<tr>
<td><strong>LASSI</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anxiety</td>
<td>20.56 (7.14)</td>
<td>18.23 (6.38)</td>
<td>28.01 (6.81)</td>
</tr>
<tr>
<td>Attitude</td>
<td>30.86 (5.29)</td>
<td>32.26 (5.23)</td>
<td>31.25 (5.07)</td>
</tr>
<tr>
<td>Motivation</td>
<td>29.17 (6.41)</td>
<td>30.15 (5.79)</td>
<td>31.76 (5.42)</td>
</tr>
<tr>
<td>Time Mgmt.</td>
<td>24.03 (7.83)</td>
<td>26.59 (7.08)</td>
<td>23.23 (6.31)</td>
</tr>
<tr>
<td>Info. Process.</td>
<td>27.28 (5.13)</td>
<td>27.59 (6.04)</td>
<td>28.46 (5.46)</td>
</tr>
<tr>
<td>Select. Main Ideas</td>
<td>23.75 (6.68)</td>
<td>23.69 (7.57)</td>
<td>31.47 (5.12)</td>
</tr>
<tr>
<td>Self-Testing</td>
<td>23.25 (6.49)</td>
<td>25.95 (6.55)</td>
<td>23.63 (6.09)</td>
</tr>
<tr>
<td>Test Strategies</td>
<td>26.09 (5.80)</td>
<td>25.69 (5.95)</td>
<td>31.46 (4.54)</td>
</tr>
<tr>
<td>Concentration</td>
<td>23.63 (7.87)</td>
<td>25.10 (7.52)</td>
<td>27.08 (6.47)</td>
</tr>
<tr>
<td>Study Aides</td>
<td>26.36 (5.34)</td>
<td>26.92 (5.67)</td>
<td>23.89 (4.65)</td>
</tr>
</tbody>
</table>
A one-way Analysis of Variance (ANOVA) (Tabachnick & Fidell, 1996) was conducted to determine whether any meaningful differences existed between the Learning Disability (LD) and Low-Achieving (LA) groups. Only one group contrast was significant \( (p < .05) \), specifically, Self-Testing on the LASSI \( (p = .04) \). However, after applying the Bonferroni correction for multiple tests, no contrasts were statistically significant. Therefore, the two samples were collapsed into one for the analysis of data. The new group was labeled “Low Achievement”. Results from the ANOVA are summarized in Table 4-4. Means and standard deviations of the variables of interest for this newly constructed group are provided in Table 4-5. As well, Cohen’s D is presented to provide a measure of distance between group means.

Table 4-4 Analysis of Variance Comparisons of Learning Disabled and Low Achieving Groups

<table>
<thead>
<tr>
<th>Domain</th>
<th>F (p-value)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ACES</strong></td>
<td></td>
</tr>
<tr>
<td>Academic Skills</td>
<td>1.93 (0.17)</td>
</tr>
<tr>
<td>Reading/Writing</td>
<td>1.39 (0.24)</td>
</tr>
<tr>
<td>Math/Science</td>
<td>0.25 (0.62)</td>
</tr>
<tr>
<td>Critical Thinking</td>
<td>2.44 (0.12)</td>
</tr>
<tr>
<td>Enablers Total</td>
<td>0.04 (0.84)</td>
</tr>
<tr>
<td>Interpersonal</td>
<td>0.33 (0.57)</td>
</tr>
<tr>
<td>Engagement</td>
<td>3.73 (0.06)</td>
</tr>
<tr>
<td>Motivation</td>
<td>0.07 (0.80)</td>
</tr>
<tr>
<td>Study Skills</td>
<td>0.78 (0.38)</td>
</tr>
</tbody>
</table>
Table 4-4 *Continued*

<table>
<thead>
<tr>
<th>LASSI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anxiety</td>
</tr>
<tr>
<td>Attitude</td>
</tr>
<tr>
<td>Motivation</td>
</tr>
<tr>
<td>Time Management</td>
</tr>
<tr>
<td>Information Processing</td>
</tr>
<tr>
<td>Selecting Main Ideas</td>
</tr>
<tr>
<td>Self-Testing</td>
</tr>
<tr>
<td>Test Strategies</td>
</tr>
<tr>
<td>Concentration</td>
</tr>
<tr>
<td>Study Aides</td>
</tr>
</tbody>
</table>

*p*< 0.05

Table 4-5 *Means and Standard Deviations for Low Achievement and Comparison Groups*

<table>
<thead>
<tr>
<th>Domain</th>
<th>Low Ach. M (SD)</th>
<th>Comparison M (SD)</th>
<th>Cohen’s D</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N=103</td>
<td>N=104</td>
<td></td>
</tr>
<tr>
<td>ACES</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Academic Skills</td>
<td>88.41 (15.40)</td>
<td>111.93 (15.88)</td>
<td>1.50</td>
</tr>
<tr>
<td>Reading/Writing</td>
<td>32.21 (7.64)</td>
<td>38.15 (6.03)</td>
<td>0.87</td>
</tr>
<tr>
<td>Math/Science</td>
<td>23.36 (6.96)</td>
<td>34.99 (7.20)</td>
<td>1.63</td>
</tr>
<tr>
<td>Critical Thinking</td>
<td>32.71 (6.37)</td>
<td>38.85 (6.16)</td>
<td>0.98</td>
</tr>
<tr>
<td>Enablers Total</td>
<td>143.19 (18.48)</td>
<td>149.11 (15.44)</td>
<td>0.35</td>
</tr>
<tr>
<td>Interpersonal</td>
<td>33.76 (4.38)</td>
<td>34.27 (3.94)</td>
<td>0.12</td>
</tr>
<tr>
<td>Engagement</td>
<td>29.28 (5.75)</td>
<td>30.39 (5.64)</td>
<td>0.19</td>
</tr>
<tr>
<td>Motivation</td>
<td>39.39 (6.39)</td>
<td>41.09 (5.94)</td>
<td>0.28</td>
</tr>
<tr>
<td>Study Skills</td>
<td>40.83 (6.61)</td>
<td>43.45 (4.91)</td>
<td>0.45</td>
</tr>
</tbody>
</table>
Due to the small sample size and subsequent collapse of the LD and LA groups into one “Low Achievement” group, the original three-group model was reduced to a two-group analysis, allowing examination of extreme student groups; based on this reduction of groups, the group membership variable was removed from the regression analysis. Furthermore, difficulties with obtaining similar or complete data regarding college entrance exam scores necessitated the elimination of this variable from the regression analysis. These difficulties with data collection are further discussed throughout this chapter. Based on this information, the following revised research questions were pursued through statistical analysis:

<table>
<thead>
<tr>
<th>LASSI</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Anxiety</td>
<td>19.68 (6.92)</td>
<td>28.02 (6.81)</td>
<td>1.21</td>
</tr>
<tr>
<td>Attitude</td>
<td>31.39 (5.28)</td>
<td>31.25 (5.07)</td>
<td>0.03</td>
</tr>
<tr>
<td>Motivation</td>
<td>29.54 (6.17)</td>
<td>31.76 (5.42)</td>
<td>0.38</td>
</tr>
<tr>
<td>Time Mgmt.</td>
<td>25.00 (7.62)</td>
<td>23.23 (6.31)</td>
<td>0.25</td>
</tr>
<tr>
<td>Inf. Processing</td>
<td>27.40 (5.47)</td>
<td>28.46 (5.46)</td>
<td>0.19</td>
</tr>
<tr>
<td>Select. Mn. Idea</td>
<td>23.73 (7.00)</td>
<td>31.47 (5.12)</td>
<td>1.28</td>
</tr>
<tr>
<td>Self-Testing</td>
<td>24.27 (6.61)</td>
<td>23.63 (6.09)</td>
<td>0.10</td>
</tr>
<tr>
<td>Test Strategies</td>
<td>25.94 (5.83)</td>
<td>31.46 (4.54)</td>
<td>1.06</td>
</tr>
<tr>
<td>Concentration</td>
<td>24.19 (7.74)</td>
<td>27.08 (6.47)</td>
<td>0.41</td>
</tr>
<tr>
<td>Study Aides</td>
<td>26.57 (5.45)</td>
<td>23.89 (4.65)</td>
<td>0.53</td>
</tr>
</tbody>
</table>
1. How well do the ACES and the LASSI discriminate between extreme student achievement groups?
2. Can these instruments be used to classify students into categorical groups, and what specific scales provide the greatest discriminatory information?
3. What is the strength of relationship between the ACES and LASSI?
4. Do these instruments add to the predictive ability of high school grade point averages, when examining college performance as measured by GPA?

To answer these questions, six analyses were conducted. First, two Multivariate Analyses of Variance (MANOVA) procedures were conducted to determine if there are detectable differences between student groups related to their performance on the ACES and the LASSI. Second, four Discriminant Analyses were conducted to determine the degree to which these instruments (as a whole) can correctly classify students into achievement groupings, and which variables included in the ACES and the LASSI most effectively discriminate between groups of students. Third, a Canonical Correlation analysis was conducted to determine the multivariate relationship between the ACES and LASSI scales; and specifically the strength of relationship between the two sets of scales. Finally, two Hierarchical Multiple Regression analyses were conducted to determine the extent to which the ACES and the LASSI add to the predictive ability of high school grade point averages when examining end of semester college GPA’s for all participants.

Analysis of Assumptions for Multivariate Procedures

Graphical Examination of the Data for Normality

All data appeared normal according to univariate graphical examination. Normality plots were also examined to determine the degree to which the data sets correspond with a normal distribution (represented by a diagonal straight line). Although there are visible peaks and valleys, the overall shape of the distributions follow the line, suggesting normality.

Missing Data

No missing data was indicated for LASSI and ACES scores. Missing data for high school and semester GPA’s was problematic. These cases were excluded from the
hierarchical regression analysis. However, based on the number of subjects left over for analysis, there was no need to replace or impute data.

Outliers

According to Hair, Anderson, Tatham, and Black (1998), outliers may differ from the rest of the sample, but may also represent characteristics of the population that might not otherwise have been captured by the normal curve analysis. Outliers can be classified into one of four major categories: procedural error (data entry errors or mistakes in coding), extraordinary event outliers (data that occurs as a result of something unusual), no explanation outliers, and outliers within the ordinary range of values. Ordinary range outliers are within acceptable ranges for the variables they are associated with, but are unique in their combination of values across the variables. These are most commonly retained in the analysis, unless there is specific evidence for a reason to delete the observation. In the present situation, each outlier was examined. One outlier was determined to be related to human, data-entry error, and was corrected as such. The remaining outliers could be considered ordinary outliers, in that their scores occurred well within the acceptable range of scores for each variable, and are likely attributable to reporter characteristics. However, in the interest of eliminating extreme scores, scores that were more than three standard deviations from the overall mean score for each variable were deleted from the analysis. This resulted in the exclusion of three cases. The overall sample size was reduced to 204; the Low Achievement group was reduced to 101, and the Comparison group was reduced to 103 total participants.

Homoscedasticity

Tests for homoscedasticity are often included in the multivariate analyses for various statistical procedures (i.e., Box’s M and Levene’s test in MANOVA). A test of the homogeneity of variance was conducted using the newly constructed two-group set of variables. Essentially, the purpose of this analysis is to determine if variances and covariances across groups for each variable are similar. Statistically significant findings using Levene’s statistic indicate unequal variances and are problematic for certain multivariate analyses. Table 4-6 contains a summary of this data. Six variables of interest presented with unequal variances (based on the mean scores) across groups:
ACES Reading/Writing, ACES Study Skills, LASSI Time Management, LASSI Selecting Main Ideas, LASSI Test Strategies, and LASSI Concentration.

Table 4-6 Levene’s Test for Unequal Variance for Two-Groups

<table>
<thead>
<tr>
<th>Domain</th>
<th>Levene Statistic ($p$-value)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ACES</strong></td>
<td></td>
</tr>
<tr>
<td>Reading/Writing</td>
<td>6.12 (0.01)*</td>
</tr>
<tr>
<td>Math/Science</td>
<td>1.14 (0.29)</td>
</tr>
<tr>
<td>Critical Thinking</td>
<td>0.31 (0.58)</td>
</tr>
<tr>
<td>Interpersonal</td>
<td>1.77 (0.19)</td>
</tr>
<tr>
<td>Engagement</td>
<td>0.02 (0.88)</td>
</tr>
<tr>
<td>Motivation</td>
<td>0.01 (0.92)</td>
</tr>
<tr>
<td>Study Skills</td>
<td>9.82 (0.00)*</td>
</tr>
<tr>
<td><strong>LASSI</strong></td>
<td></td>
</tr>
<tr>
<td>Anxiety</td>
<td>0.76 (0.39)</td>
</tr>
<tr>
<td>Attitude</td>
<td>0.40 (0.53)</td>
</tr>
<tr>
<td>Motivation</td>
<td>1.47 (0.23)</td>
</tr>
<tr>
<td>Time Management</td>
<td>9.16 (0.00)*</td>
</tr>
<tr>
<td>Information Processing</td>
<td>0.00 (0.96)</td>
</tr>
<tr>
<td>Selecting Main Ideas</td>
<td>9.10 (0.00)*</td>
</tr>
<tr>
<td>Self-Testing</td>
<td>0.48 (0.49)</td>
</tr>
<tr>
<td>Test Strategies</td>
<td>3.87 (0.05)*</td>
</tr>
<tr>
<td>Concentration</td>
<td>4.14 (0.04)</td>
</tr>
<tr>
<td>Study Aides</td>
<td>1.11 (0.29)</td>
</tr>
</tbody>
</table>

*p<0.05"
For MANOVA, a Box M statistic also indicates differences between variance and covariance matrices across groups. However, a violation of this assumption has minimal impact if the groups are of approximately equal size (Hair et al., 1998). Specifically, if the group size of the larger group, divided by the smaller group yields a ratio less than 1.5, then a MANOVA can be considered robust to handle a violation of this assumption. In the present case, after collapsing the LD and LA groups, the sample sizes are approximately equivalent, (n= 101 low achievement and 103 comparison), yielding a ratio of 1.02, indicating the MANOVA and Discriminant Analysis procedures are robust to this violation.

*Linearity*

Linearity is assumed based on the nature of the theoretical relationship between the LASSI and the ACES; that is, both tests theoretically serve as measures of the same construct.

*Analyses I and II*

The first two analyses address the ability of the ACES and the LASSI to differentiate between low achieving students (students with learning disabilities and low achieving students) and students without learning problems (comparison group) using raw score data. The first specific analysis examined score differences between the ACES academic skills subscales (reading/writing, math/science, critical thinking) and academic enablers subscales (motivation, study skills, engagement, interpersonal skills) using a Multivariate Analysis of Variance (MANOVA) (Tabachnick & Fidell, 1996; Wienfurt, 1995).

As previously reported, violations of the equal variance/covariance assumption was detected for the overall model (Box’s M $F=$[28, 142070] 1.72, $p = .01$). Specifically, Levene’s test detected unequal variance and covariance matrices between groups for the reading/writing subdomain ($p = .01$) and the study skills domain ($p = .00$). Wilk’s Lambda and Pillai’s trace are considered, as these statistical tests are purported to be the most immune to violations of the assumptions underlying MANOVA. However, Pillai’s trace is preferred for interpretation if there are violations indicated by the Box’s M test (Hair et al., 1998). Examination of both the Wilk’s Lambda ($F=$[7, 196] 23.92, $p=0.00$)
and Pillai’s Trace ($F=[7, 196] \ 23.92, \ p=0.00$) statistics indicated a rejection of the null hypotheses for identical means between groups. Eta-Squared for both statistical tests indicated moderate effect sizes (0.46).

Tests of between-subjects effects were conducted to investigate differences between groups for each dependent variable. Because the omnibus test for a multivariate effect yielded a significant finding, univariate examination could be conducted without concern for inflating family-wise error rate. Significant mean differences between groups were found for Reading/Writing, Math/Science, Critical Thinking, and Study Skills, using a Bonferroni corrected alpha of 0.007. No differences were found between groups in terms of Interpersonal skills, Engagement or Motivation. Examination of Eta-Squared indicated small to moderate effect sizes. See Table 4-7.

<table>
<thead>
<tr>
<th>Variable</th>
<th>df</th>
<th>$F$</th>
<th>p-value</th>
<th>Eta Squared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading/Writing</td>
<td>1</td>
<td>38.11*</td>
<td>0.00*</td>
<td>0.16</td>
</tr>
<tr>
<td>Math/Science</td>
<td>1</td>
<td>138.73*</td>
<td>0.00*</td>
<td>0.41</td>
</tr>
<tr>
<td>Critical Thinking</td>
<td>1</td>
<td>49.20*</td>
<td>0.00*</td>
<td>0.20</td>
</tr>
<tr>
<td>Interpersonal</td>
<td>1</td>
<td>0.52</td>
<td>0.47</td>
<td>0.00</td>
</tr>
<tr>
<td>Engagement</td>
<td>1</td>
<td>1.60</td>
<td>0.21</td>
<td>0.01</td>
</tr>
<tr>
<td>Motivation</td>
<td>1</td>
<td>3.13</td>
<td>0.08</td>
<td>0.02</td>
</tr>
<tr>
<td>Study Skills</td>
<td>1</td>
<td>9.41*</td>
<td>0.00*</td>
<td>0.05</td>
</tr>
</tbody>
</table>

*Indicates statistical significance at the 0.05 level after Bonferroni correction.

No post-hoc analyses were conducted, as there were only two groups considered. As such, examination of the means provided information for how the groups differed in terms of ACES scores. In each case, the mean score for the comparison group exceeded that of the low achievement group.
The second goal of this analysis was to examine statistical differences between the Low Achievement and Comparison groups for scores on the ten subscales of the LASSI. Again, as Wilk’s Lambda and Pillai’s trace are considered to be the statistics most immune to violations of the assumptions underlying MANOVA, they are reported here (Hair et al., 1998). However, Pillai’s trace is preferred for interpretation if there are violations indicated by the Box’s M test. Examination of both statistics (Wilk’s Lambda and Pillai’s Trace ($F=[10, 193] 14.60, p=0.00$)) indicated a rejection of the null hypotheses for identical means between groups ($p = .00$). Examination of Eta-Squared for the overall test indicated a moderate effect size (0.43).

Tests for between-subjects effects were conducted to detect differences between groups for each dependent variable, using a corrected alpha of 0.005. Significant mean differences between groups were found for Anxiety, Selecting Main Ideas, Test Strategies, and Study Aides. No differences were found between groups in terms of Attitude, Time Management, Information Processing, Self-testing, Motivation, or Concentration. Please see Table 4-8.

<table>
<thead>
<tr>
<th>Variable</th>
<th>df</th>
<th>$F$</th>
<th>$p$-value</th>
<th>Eta-Squared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anxiety</td>
<td>1</td>
<td>77.09*</td>
<td>0.00*</td>
<td>0.28</td>
</tr>
<tr>
<td>Attitude</td>
<td>1</td>
<td>0.05</td>
<td>0.82</td>
<td>0.00</td>
</tr>
<tr>
<td>Motivation</td>
<td>1</td>
<td>7.26</td>
<td>0.01</td>
<td>0.04</td>
</tr>
<tr>
<td>Time Management</td>
<td>1</td>
<td>3.74</td>
<td>0.06</td>
<td>0.02</td>
</tr>
<tr>
<td>Inf. Processing</td>
<td>1</td>
<td>2.39</td>
<td>0.12</td>
<td>0.01</td>
</tr>
<tr>
<td>Select Main Ideas</td>
<td>1</td>
<td>79.20*</td>
<td>0.00*</td>
<td>0.28</td>
</tr>
<tr>
<td>Self-Testing</td>
<td>1</td>
<td>0.49</td>
<td>0.49</td>
<td>0.00</td>
</tr>
<tr>
<td>Test Strategies</td>
<td>1</td>
<td>56.40*</td>
<td>0.00*</td>
<td>0.22</td>
</tr>
<tr>
<td>Concentration</td>
<td>1</td>
<td>8.52</td>
<td>0.01</td>
<td>0.04</td>
</tr>
<tr>
<td>Study Aides</td>
<td>1</td>
<td>14.98*</td>
<td>0.00*</td>
<td>0.07</td>
</tr>
</tbody>
</table>

*Indicates statistical significance at the 0.05 level after Bonferroni correction.
Again, no post-hoc analyses were conducted as there were only two groups for the analysis. As such, examination of the means provided information for how the groups differed in terms of LASSI scores. For comparisons that resulted in significant differences, comparison group mean scores exceeded the low achieving group scores for all but the Study Aides variable.

A second goal of this analysis was to determine the accuracy of each instrument in the classification of students into one of two groups (Low Achievement or Comparison). This was executed using a stepwise estimation procedure for deriving discriminant functions and a simultaneous entry method allowing interpretation of the entire set of variables.

The purpose of the Stepwise Discriminant Analysis (Tabachnick & Fidell, 1996) is to identify the combination of variables that best discriminate between groups, and to use that combination of variables to classify subjects into their respective groups. It is typically done as a follow-up to a MANOVA, as was the case for this investigation. Procedurally, the variable with the best discriminating power is chosen, and subsequent variables are paired with that variable, until the variables that best improve its discriminating power are retained in the model. This allows the researcher to identify a smaller number of variables for use in classification.

When using stepwise methods, the Mahalanobis $D^2$ measure of squared Euclidean distance is most appropriate, and will adjust for unequal variances ($Box’s\ M = 17.91, F_{[3,7436098]} = 5.64, p = .001$) (Hair et al., 1998). For the first analysis conducted with the ACES, a discriminant function consisting of two ACES variables (Math/Science and Reading/Writing) was identified. The overall multivariate test was significant at the 0.05 level ($Wilk’s\ Lambda = .56, chi-square$ with 2 degrees of freedom $= 115.87, p = 0.00$), thus supporting an attempt to classify individuals into different groups. Considering the standardized discriminant function coefficients, the dominant predictor variable was Math/Science with a coefficient of 0.88. The coefficient for Reading/Writing was 0.35.

A classification matrix (Table 4-9) was constructed to determine how well the discriminant function was able to discriminate between groups. A hit rate was derived and presented by SPSS, which allowed visual inspection of the total number of cases correctly classified for each group. In this case, 88 (87.1%) of the Low Achievement
students were correctly classified, while 81 (78.6%) of the Comparison students were correctly classified. This translates into 82.8% of all cases being correctly classified. Generally speaking, there are no guidelines for evaluating the practical importance of classification accuracy; however, some researchers suggest that classification accuracy should be at least one-fourth greater than chance (Hair et al., 1998). In this case, prior chance classification was 0.50 (based on two groups with approximately equal sample sizes). Therefore, a classification rate of 62.5% or higher is considered acceptable, indicating that this particular hit rate was both statistically and practically significant.

Table 4-9 ACES Stepwise Classification Results

<table>
<thead>
<tr>
<th>Actual Group</th>
<th>Number Of Cases</th>
<th>Predicted Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Ach.</td>
<td>101</td>
<td>88</td>
</tr>
<tr>
<td>Comparison</td>
<td>103</td>
<td>22</td>
</tr>
</tbody>
</table>

*a The total percent of cases correctly classified was 82.8%

For the LASSI analysis, Mahalanobis $D^2$ was again used to adjust for unequal variances ($Box's M = 27.79, F [6,295326.2] = 4.56, p = .000$). A discriminant function consisting of three LASSI variables (Selecting Main Ideas, Anxiety and Study Aides) was identified. Considering the standardized discriminant function coefficients, the dominant predictor variable was Selecting Main Ideas with a coefficient of .601. The coefficient for Anxiety (0.50) and Study Aides (-0.42) followed in predictive capability, respectively. The overall multivariate test was statistically significant at the 0.05 level ($Wilk's Lambda = 0.61, chi-square$ with 3 degrees of freedom = 99.77, $p = 0.00$), thus supporting an attempt to classify individuals into different groups. The derived classification matrix indicated that this variate was able to correctly classify 78 (77.2%)
of the Low Achievement group correctly and 85 (82.5%) of the Comparison group correctly, resulting in an overall classification rate of 79.9%, well above the accepted minimum of 62.5% based on a 0.50 classification rate, indicating both statistical and practical significance.

Table 4-10 LASSI Stepwise Classification Results

<table>
<thead>
<tr>
<th>Actual Group</th>
<th>Number Of Cases</th>
<th>Predicted Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Ach.</td>
<td>101</td>
<td>LA 78</td>
</tr>
<tr>
<td>Comparison</td>
<td>103</td>
<td>Comp. 23</td>
</tr>
</tbody>
</table>

The total percent of cases correctly classified was 79.9%

A simultaneous Discriminant Analysis (Tabachnick & Fidell, 1996) was conducted to provide information regarding the ability of each scale (in its entirety) to classify students into their respective groups. For the ACES analysis, considering the standardized discriminant function coefficients, the dominant predictor variables were again, Math/Science (0.88), Reading/Writing (0.39), and Study Skills (0.31). The overall multivariate test was statistically significant at the 0.05 level (Wilk’s Lambda = 0.54, chi-square with 7 degrees of freedom = 122.57, p = 0.00), thus supporting an attempt to classify individuals into different groups using all seven of the ACES subscales. The derived classification matrix indicated that this variate was able to correctly classify 86 (85.1%) of the Low Achievement group correctly and 83 (80.6%) of the Comparison group correctly, resulting in an overall classification rate of 82.8%, well above the accepted minimum of 62.5% based on a 0.50 classification rate, indicating both statistical and practical significance. Please refer to Table 4-11.
Table 4-11 *ACES Simultaneous Classification Results*

<table>
<thead>
<tr>
<th>Actual Group</th>
<th>Number Of Cases</th>
<th>Predicted Group</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LA</td>
<td>Comp.</td>
<td></td>
</tr>
<tr>
<td>Low Ach.</td>
<td>101</td>
<td>86</td>
<td>15</td>
</tr>
<tr>
<td>Comparison</td>
<td>103</td>
<td>20</td>
<td>83</td>
</tr>
</tbody>
</table>

*The total percent of cases correctly classified was 82.8%*

Similarly, for the LASSI, the predictor variables of Selecting Main Ideas (0.51), Anxiety (0.50), and Study Aides (-0.42) emerged as dominant predictors; however, analysis of all the LASSI variables yielded a statistically significant multivariate relationship (*Wilk’s Lambda* = 0.57, *chi-square* with 10 degrees of freedom = 110.99, *p* = 0.00). The derived classification matrix correctly classified 83 (82.2%) of the Low Achievement group and 85 (82.5%) of the Comparison group, yielding an overall classification rate of 82.4% for all cases. Please refer to Table 4-12.

Table 4-12 *LASSI Simultaneous Classification Results*

<table>
<thead>
<tr>
<th>Actual Group</th>
<th>Number Of Cases</th>
<th>Predicted Group</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LA</td>
<td>Comp.</td>
<td></td>
</tr>
<tr>
<td>Low Ach.</td>
<td>101</td>
<td>83</td>
<td>18</td>
</tr>
<tr>
<td>Comparison</td>
<td>103</td>
<td>18</td>
<td>85</td>
</tr>
</tbody>
</table>

*The total percent of cases correctly classified was 82.4%*
**Analysis III**

The third analysis examined the degree of shared variation between scales on the ACES and the LASSI to determine if the scales provide redundant information. This analysis was executed using a Canonical Correlation (Thompson, 2000). Canonical Correlation procedures allow the researcher to study inter-relationships among sets of dependent and independent variables, and simultaneously predict multiple variables (Hair et al., 1998). The purpose of the analysis is to maximize the relationship between the variable sets.

For this analysis, canonical correlation was employed to determine the shared variance between subscales on the LASSI (set one) and subscales on the ACES (set two). Ten variables were used to comprise the LASSI instrument (set 1 = Anxiety, Attitude, Motivation, Time Management, Information Processing, Selecting Main Ideas, Self-Testing, Test Strategies, Concentration, Support Aides) and seven variables were used to describe the ACES instrument (set 2 = Reading/Writing, Math/Science, Critical Thinking, Engagement, Interpersonal Skills, Motivation, Study Skills). The analysis involved the derivation of canonical functions, the relationship measured between the two canonical variates, defined as the linear composites of the variables comprising each set. The correlation matrix between the two sets of variables is reported in Table 4-13.

<table>
<thead>
<tr>
<th></th>
<th>Read/Write</th>
<th>Math/Science</th>
<th>CrThk</th>
<th>Interpers</th>
<th>Engage</th>
<th>Motiv</th>
<th>StdySkll</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anx.</td>
<td>0.35</td>
<td>0.42</td>
<td>0.31</td>
<td>0.05</td>
<td>0.20</td>
<td>0.27</td>
<td>0.26</td>
</tr>
<tr>
<td>Att.</td>
<td>0.07</td>
<td>-0.01</td>
<td>0.13</td>
<td>0.21</td>
<td>0.29</td>
<td>0.50</td>
<td>0.39</td>
</tr>
<tr>
<td>Motiv.</td>
<td>0.15</td>
<td>0.23</td>
<td>0.25</td>
<td>0.29</td>
<td>0.43</td>
<td>0.67</td>
<td>0.62</td>
</tr>
<tr>
<td>Time</td>
<td>-0.07</td>
<td>-0.03</td>
<td>-0.02</td>
<td>0.15</td>
<td>0.31</td>
<td>0.45</td>
<td>0.55</td>
</tr>
<tr>
<td>InfPro</td>
<td>0.10</td>
<td>0.15</td>
<td>0.28</td>
<td>0.20</td>
<td>0.38</td>
<td>0.43</td>
<td>0.32</td>
</tr>
<tr>
<td>Select</td>
<td>0.48</td>
<td>0.42</td>
<td>0.39</td>
<td>0.03</td>
<td>0.29</td>
<td>0.034</td>
<td>0.36</td>
</tr>
<tr>
<td>SlfTst</td>
<td>-0.02</td>
<td>-0.09</td>
<td>0.03</td>
<td>0.29</td>
<td>0.33</td>
<td>0.44</td>
<td>0.44</td>
</tr>
</tbody>
</table>

Table 4-13 *Correlation Matrix between ACES and LASSI subscales*
The solution identified seven canonical correlations (consistent with the literature stating that the number of correlations is limited to the number of variables in the smaller data set), four of which were statistically significant ($p<0.05$). The magnitude of the relationships between the pairs of variates, demonstrated by the canonical correlation coefficients, ranged from 0.03 to 0.79. Eigenvalues and the associated statistics for the test of the canonical solution are presented in the following table:

<table>
<thead>
<tr>
<th>$R_c$</th>
<th>Wilk’s Lambda</th>
<th>Chi Square</th>
<th>$df$</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.79</td>
<td>0.15</td>
<td>369.45</td>
<td>70</td>
<td>0.00*</td>
</tr>
<tr>
<td>0.62</td>
<td>0.40</td>
<td>177.77</td>
<td>54</td>
<td>0.00*</td>
</tr>
<tr>
<td>0.43</td>
<td>0.64</td>
<td>85.55</td>
<td>40</td>
<td>0.00*</td>
</tr>
<tr>
<td>0.34</td>
<td>0.80</td>
<td>45.71</td>
<td>28</td>
<td>0.03*</td>
</tr>
<tr>
<td>0.24</td>
<td>0.89</td>
<td>21.94</td>
<td>10</td>
<td>0.38</td>
</tr>
<tr>
<td>0.22</td>
<td>0.95</td>
<td>10.75</td>
<td>10</td>
<td>0.38</td>
</tr>
<tr>
<td>0.07</td>
<td>1.00</td>
<td>1.04</td>
<td>4</td>
<td>0.90</td>
</tr>
</tbody>
</table>

*$p<0.05$

Although this particular analysis suggests the interpretation of four different canonical roots, Hair et al. (1998) suggests that two additional criteria should be
employed when determining which canonical roots to interpret. First, the practical significance of the canonical function (the size of the canonical correlation) should be considered. There are currently no explicitly stated rules for determining what is practically significant; however, similar to factor analysis, the percentage of variance criterion can be employed. Specifically, by squaring the canonical coefficients, one can arrive at an estimate of the amount of variance from the two data sets that a canonical variate is able to explain (Hair et al., 1998; Thompson, 1984). In the social sciences, a solution that accounts for 60% or more of the total variance is considered satisfactory. Taking this criterion into consideration, only the first variate (0.79) accounts for more than 60% of the total extracted variance (63%), suggesting that only the first canonical root provides adequate interpretive value. However, examination of the second canonical root may be of value from a theoretical standpoint, despite falling short of the 60% criterion.

A squared canonical root, despite being able to represent the shared variance between canonical variates, is limited to the variance extracted by the variates. In other words, if the variates do not account for all the variance available for extraction from the variable sets, then the squared root is equally limited. Therefore, if a variate does not extract a significant portion of variance from the variable sets, even statistically significant roots may not have much practical application. As such, the redundancy measure of shared variance should also be interpreted. According to Hair et al. (1998), the redundancy index is equivalent to an average $R^2$, representing the ability of one variable set to explain the variation present in each of the variables from the other set. In most cases, interpretation of the redundancy index representing the variance extracted by the independent variate is sufficient. Similar to the interpretation of a scree plot of Eigenvalues in factor analysis, examination of the absolute values of the redundancy indices provides further support for interpretation of the first root, as well as moderate support for interpretation of the second.

Taken together, there is sufficient evidence to interpret the first two canonical roots. Using an accepted cutoff score of $|0.35|$, the canonical loadings for each set were examined for the first two variates to determine which subscales comprise the respective
variates. Again, similar to factor analysis, the loadings with the highest values are assigned to each root (see Table 4-15) (Thompson, 1984).

<table>
<thead>
<tr>
<th>LASSI</th>
<th>Root 1</th>
<th>Root 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anxiety</td>
<td>-0.44</td>
<td>-0.60</td>
</tr>
<tr>
<td>Attitude</td>
<td>-0.59</td>
<td>0.25</td>
</tr>
<tr>
<td>Motivation</td>
<td>-0.91</td>
<td>0.05</td>
</tr>
<tr>
<td>Time Management</td>
<td>-0.68</td>
<td>0.39</td>
</tr>
<tr>
<td>Information Processing</td>
<td>-0.55</td>
<td>0.03</td>
</tr>
<tr>
<td>Selecting Main Ideas</td>
<td>-0.56</td>
<td>-0.67</td>
</tr>
<tr>
<td>Self-Testing</td>
<td>-0.59</td>
<td>0.45</td>
</tr>
<tr>
<td>Test Strategies</td>
<td>-0.71</td>
<td>-0.49</td>
</tr>
<tr>
<td>Concentration</td>
<td>-0.70</td>
<td>-0.21</td>
</tr>
<tr>
<td>Study Aids</td>
<td>-0.58</td>
<td>0.60</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ACES</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading/Writing</td>
<td>-0.30</td>
<td>-0.67</td>
</tr>
<tr>
<td>Math/Science</td>
<td>-0.30</td>
<td>-0.81</td>
</tr>
<tr>
<td>Critical Thinking</td>
<td>-0.36</td>
<td>-0.59</td>
</tr>
<tr>
<td>Interpersonal</td>
<td>-0.38</td>
<td>0.35</td>
</tr>
<tr>
<td>Engagement</td>
<td>-0.65</td>
<td>0.05</td>
</tr>
<tr>
<td>Motivation</td>
<td>-0.87</td>
<td>0.09</td>
</tr>
<tr>
<td>Study Skills</td>
<td>-0.88</td>
<td>0.11</td>
</tr>
</tbody>
</table>

The interpretation of the canonical variates calls for examination of the variables that comprise each variate to determine if there is a readily interpretable relationship between the variables. Similar to exploratory factor analysis, the variates can be labeled to capture the underlying or common relationship between the variable sets. The first
variate is comprised of Attitude, Motivation, Time Management, Information Processing, Self-Testing, Test Strategies, and Concentration from the LASSI, as well as Engagement, Motivation, and Study Skills from the ACES. This particular root could be labeled a global factor, as well as a process factor. In other words, the subscales captured by this canonical root are characterized by self or goal-regulation strategies and are the actions that make a learner successful, or “endurance” variables. The second root is comprised of Anxiety, Selecting Main Ideas, and Support Aides from the LASSI, as well as Reading/Writing, Math/Science, and Critical Thinking from the ACES. This canonical root could be labeled a content domain, or a “skills” root. In other words, the subtests that represent this root are related to abilities, strategies, or the mechanics of successful learning.

Analysis IV

The fourth analysis attempted to determine the predictive power of the LASSI and the ACES when predicting semester grade point averages. Specifically, do the LASSI or the ACES add any predictive power beyond knowledge of high school performance, when determining academic success in college (as measured by current semester GPA)? The originally proposed data analysis procedure was modified due to difficulties with data collection. Specifically, the LD status variable was dropped from the original analysis after collapsing the LD and LA groups. Difficulty obtaining standardized entrance exam scores necessitated the exclusion of this variable as well. Specifically, subjects had taken one of three different entrance exams (i.e., Scholastic Aptitude Test, American College Test, College Placement Test) and comparability was limited. In addition to difficulties obtaining exam score data, in the interest of parsimony, the individual variables of the ACES and the LASSI were not used for this analysis, as such a large number of variables would complicate findings and reduce the utility of deriving a predictive equation. Instead, a “competence” score was derived for each instrument, based on levels of performance specified by the respective authors of each instrument. Specifically, the
competence scores (i.e., developing, competent, and advanced) derived from the ACES (DiPerna & Elliott, 2001) were assigned values of one, two, and three, respectively, then summed across subdomains (i.e., Reading/Writing, Math/Science, Critical Thinking, Interpersonal, Engagement, Motivation, and Study Skills) to produce a score ranging from 7 to 21 for each participant. LASSI competence scores were derived similarly using scoring interpretations offered by the instrument (Weinstein, 1987). Specifically, scores falling at or below the 50th percentile (considered areas of relative weakness) were assigned a value of one. Scores between the 50th and 75th percentiles (considered areas that may need improvement) were assigned a value of two; scores at or above the 75th percentile (considered areas of relative strength) were assigned a value of three. The 10 competence scores were summed for each participant, thus allowing a score between 10 and 30. The competence scores were used for the regression analysis.

For interpretation purposes, the respective percentile and decile ranks for the average competence scores per scale and by group are reported in Table 4-16.

Table 4-16 Mean Competence Scores and Decile/Percentile Ranks by Scale and Group

<table>
<thead>
<tr>
<th>Domain/Group</th>
<th>Raw Score M (SD)</th>
<th>Competence M (SD)</th>
<th>Decile/Percentile*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ACES</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reading/Writing</td>
<td>36.25 (7.10)</td>
<td>2.03 (0.71)</td>
<td>5</td>
</tr>
<tr>
<td>Low Ach.</td>
<td>33.27 (7.12)</td>
<td>1.75 (0.76)</td>
<td>3</td>
</tr>
<tr>
<td>Comparison</td>
<td>38.23 (6.40)</td>
<td>2.22 (0.62)</td>
<td>6</td>
</tr>
<tr>
<td>Math/Science</td>
<td>30.10 (9.08)</td>
<td>1.57 (0.70)</td>
<td>2</td>
</tr>
<tr>
<td>Low Ach.</td>
<td>23.02 (7.08)</td>
<td>1.15 (0.41)</td>
<td>1</td>
</tr>
<tr>
<td>Comparison</td>
<td>34.82 (6.97)</td>
<td>1.85 (0.72)</td>
<td>5</td>
</tr>
<tr>
<td>Critical Thinking</td>
<td>36.70 (6.81)</td>
<td>2.02 (0.73)</td>
<td>5</td>
</tr>
<tr>
<td>Low Ach.</td>
<td>33.12 (6.13)</td>
<td>1.73 (0.69)</td>
<td>3</td>
</tr>
<tr>
<td>Comparison</td>
<td>39.09 (6.19)</td>
<td>2.21 (0.69)</td>
<td>6</td>
</tr>
</tbody>
</table>
Table 4-16 Continued

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>SD</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Interpersonal</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low Ach.</td>
<td>33.98 (4.29)</td>
<td>2.06 (0.54)</td>
<td>5</td>
</tr>
<tr>
<td>Comparison</td>
<td>34.10 (4.13)</td>
<td>2.06 (0.52)</td>
<td>6</td>
</tr>
<tr>
<td><strong>Engagement</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low Ach.</td>
<td>29.71 (5.40)</td>
<td>1.86 (0.52)</td>
<td>4</td>
</tr>
<tr>
<td>Comparison</td>
<td>29.92 (5.48)</td>
<td>1.88 (0.51)</td>
<td>4</td>
</tr>
<tr>
<td><strong>Motivation</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low Ach.</td>
<td>40.66 (6.29)</td>
<td>1.84 (0.62)</td>
<td>4</td>
</tr>
<tr>
<td>Comparison</td>
<td>41.13 (5.88)</td>
<td>1.87 (0.65)</td>
<td>4</td>
</tr>
<tr>
<td><strong>Study Skills</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Low Ach.</td>
<td>42.97 (5.21)</td>
<td>2.08 (0.51)</td>
<td>4</td>
</tr>
<tr>
<td>Comparison</td>
<td>43.59 (4.46)</td>
<td>2.14 (0.48)</td>
<td>5</td>
</tr>
<tr>
<td><strong>LASSI</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anxiety</td>
<td>25.12 (8.24)</td>
<td>1.75 (0.88)</td>
<td>45</td>
</tr>
<tr>
<td>Low Ach.</td>
<td>19.94 (7.35)</td>
<td>1.29 (0.64)</td>
<td>20</td>
</tr>
<tr>
<td>Comparison</td>
<td>28.56 (6.91)</td>
<td>2.06 (0.89)</td>
<td>65</td>
</tr>
<tr>
<td>Attitude</td>
<td>31.66 (4.99)</td>
<td>1.46 (0.77)</td>
<td>20</td>
</tr>
<tr>
<td>Low Ach.</td>
<td>31.92 (5.27)</td>
<td>1.52 (0.78)</td>
<td>20</td>
</tr>
<tr>
<td>Comparison</td>
<td>31.49 (4.82)</td>
<td>1.42 (0.76)</td>
<td>20</td>
</tr>
<tr>
<td>Concentration</td>
<td>26.48 (7.31)</td>
<td>1.67 (0.85)</td>
<td>40</td>
</tr>
<tr>
<td>Low Ach.</td>
<td>24.90 (7.98)</td>
<td>1.56 (0.83)</td>
<td>30</td>
</tr>
<tr>
<td>Comparison</td>
<td>27.53 (6.68)</td>
<td>1.74 (0.86)</td>
<td>45</td>
</tr>
<tr>
<td>Inf. Process.</td>
<td>27.63 (5.24)</td>
<td>1.72 (0.84)</td>
<td>50</td>
</tr>
<tr>
<td>Low Ach.</td>
<td>27.13 (5.35)</td>
<td>1.75 (0.86)</td>
<td>50</td>
</tr>
<tr>
<td>Comparison</td>
<td>27.96 (5.17)</td>
<td>1.71 (0.82)</td>
<td>50</td>
</tr>
<tr>
<td>Motivation</td>
<td>30.98 (5.79)</td>
<td>1.68 (0.88)</td>
<td>35</td>
</tr>
<tr>
<td>Low Ach.</td>
<td>29.87 (6.33)</td>
<td>1.63 (0.89)</td>
<td>30</td>
</tr>
<tr>
<td>Comparison</td>
<td>31.73 (5.31)</td>
<td>1.72 (0.88)</td>
<td>45</td>
</tr>
</tbody>
</table>
Internal consistency estimates of reliability were computed for the ACES and LASSI competence scores. For the ACES, seven subscales (not including composite scores) were used in the analysis, and 10 were used for the LASSI. The purpose of computing coefficient alphas was to provide a measure of how well the competence ratings provided for each respective instrument measured a single underlying construct. The alpha coefficient for the ACES was 0.71, and 0.86 for the LASSI. These scores indicate that the scales on the LASSI have a higher overall level of inter-scale correlation when compared to the ACES; however, both scales have adequate internal consistency for use in this analysis.

*Deciles are reported for the ACES and percentiles are reported for the LASSI.*
Means and standard deviations for the variables of interest in the regression analyses are reported in table 4-17.

Table 4-17 Means and Standard Deviations for Regression Variables by Group

<table>
<thead>
<tr>
<th></th>
<th>Total Sample</th>
<th>LA</th>
<th>Comparison</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n=130</td>
<td>n=52</td>
<td>n=78</td>
</tr>
<tr>
<td>High School GPA</td>
<td>M(SD)</td>
<td>M(SD)</td>
<td>M(SD)</td>
</tr>
<tr>
<td>End Semester GPA</td>
<td>M(SD)</td>
<td>M(SD)</td>
<td>M(SD)</td>
</tr>
<tr>
<td>ACES Competence Score</td>
<td>M(SD)</td>
<td>M(SD)</td>
<td>M(SD)</td>
</tr>
<tr>
<td>LASSI Competence Score</td>
<td>M(SD)</td>
<td>M(SD)</td>
<td>M(SD)</td>
</tr>
<tr>
<td>High School GPA</td>
<td>3.19 (0.61)</td>
<td>2.79 (0.61)</td>
<td>3.46 (0.43)</td>
</tr>
<tr>
<td>End Semester GPA</td>
<td>3.06 (0.80)</td>
<td>2.58 (0.92)</td>
<td>3.38 (0.48)</td>
</tr>
<tr>
<td>ACES Competence Score</td>
<td>13.46 (2.65)</td>
<td>12.31 (2.52)</td>
<td>14.23 (2.46)</td>
</tr>
<tr>
<td>LASSI Competence Score</td>
<td>16.80 (5.59)</td>
<td>16.08 (5.73)</td>
<td>17.29 (5.48)</td>
</tr>
</tbody>
</table>

The final models were as follows:
High School GPA + ACES Competence + LASSI Competence = Current GPA
High School GPA + LASSI Competence + ACES Competence = Current GPA

Two hierarchical regression analyses (Tabachnick & Fidell, 1996) were conducted to predict end of semester grades from high school grade point average; constructed competence scores on the ACES and LASSI were force-entered to determine which variable provided the most predictive power. The variables were chosen a-priori based on research, and as a means of answering the question of how useful the information derived from the LASSI and ACES are in terms of performance prediction. Each IV was assessed in terms of what it added to the equation at its own point of entry.

The results of the first analysis entering high school GPA, followed by the ACES and LASSI Competence scores, respectively, indicated that the high school GPA score accounted for a significant amount of the variance for predicted current GPA, $R^2 = 0.17$, $F$ change $(1, 128) = 26.41$, $p = .000$. ACES and LASSI competence scores added an additional $R^2$ change of 0.05 and 0.00, respectively. See table 4-18. Taking the full model
into consideration, adjusted $R^2$ indicates that approximately 20% of the variance from the end of semester GPA is accounted for using this model.

Table 4-18 Summary of Regression Results ACES

<table>
<thead>
<tr>
<th>Variable</th>
<th>Effect Estimate (β)</th>
<th>$R^2$</th>
<th>$\Delta R^2$</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>High School GPA</td>
<td>0.32</td>
<td>0.17</td>
<td>0.17</td>
<td>0.00</td>
</tr>
<tr>
<td>ACES Competence Score</td>
<td>0.22</td>
<td>0.22</td>
<td>0.05</td>
<td>0.03</td>
</tr>
<tr>
<td>LASSI Competence Score</td>
<td>0.05</td>
<td>0.22</td>
<td>0.00</td>
<td>0.62</td>
</tr>
</tbody>
</table>

The second hierarchical regression entered high school GPA, but reversed the order of entry of the ACES and LASSI competence scores. Again, high school GPA accounted for a significant amount of the current GPA variance, $R^2 = .171$, $F_{change} (1,128) = 26.41, p = .000$. Reversing the entry of the LASSI and ACES resulted in an additional $R^2_{change}$ of 0.02 and 0.03, respectively. See table 4-14. Taking the full model into consideration, 20% of the variance from the end of semester GPA was explained. When combined with the first regression analysis, this suggests that the ACES provided slightly more predictive power than the LASSI when used in combination. However, clearly, neither adds as much to the model as high school GPA.
Table 4-19 \textit{Summary of Regression Results LASSI}

<table>
<thead>
<tr>
<th>Variable</th>
<th>Effect Estimate ($\beta$)</th>
<th>$R^2$</th>
<th>$\Delta R^2$</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>High School GPA</td>
<td>0.32</td>
<td>0.17</td>
<td>0.17</td>
<td>0.00</td>
</tr>
<tr>
<td>LASSI Competence</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Score</td>
<td>0.05</td>
<td>0.19</td>
<td>0.02</td>
<td>0.62</td>
</tr>
<tr>
<td>ACES Competence</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Score</td>
<td>0.22</td>
<td>0.22</td>
<td>0.03</td>
<td>0.03</td>
</tr>
</tbody>
</table>
CHAPTER FIVE
Conclusion

The purpose of this study was to compare the ability of two standardized instruments to assess academic competence in college students. The instruments of interest were the Academic Competence Evaluation Scales – College (ACES) (DiPerna & Elliott, 2001) and the Learning and Study Strategies Inventory (LASSI) (Weinstein, 1987). The first set of analyses addressed the ability of the ACES and the LASSI to differentiate between groups of students with learning difficulties (Learning Disability and low achievement) and students without learning problems (comparison group). The second set of analyses addressed the ability of the ACES and the LASSI to correctly identify and classify students into one of two groups (low achievement or comparison). The third analysis identified the multivariate correlation between the sets of variables for the two instruments. The fourth set of analyses evaluated the ability of these two instruments to increase the predictive power of high school grades in the prediction of college performance.

Summary and Interpretation of Results

Analysis I

A one-way Analysis of Variance (ANOVA) to compare group means between the original Low-Achieving and Learning Disability groups indicated no statistically significant differences after controlling for multiple tests. As such, the groups were collapsed to form one group representing “Low Achievement” students. Two separate Multivariate Analyses of Variance (MANOVA) procedures indicated statistically significant differences between groups on both the ACES and the LASSI variables. Tests for between-subjects effects indicated significantly higher scores for the comparison
group on the Reading/Writing, Math/Science, Critical Thinking, and Study Skills subscales on the ACES and on the Anxiety, Selecting Main Ideas, Test Strategies, scales of the LASSI. In contrast, a statistically significant difference between groups was also found for the Study Aides scale of the LASSI; however, the Comparison group score was lower than the Low Achievement group mean score.

Overall, it is not surprising to find that the comparison group scored consistently better than the Low Achievement group on measures of academic skills on the ACES. The Low Achievement group is self-reporting generally lower average scores in the areas of reading, writing, math, and science. Also of interest, the Comparison group, which was drawn from the “normal” college population reported more positive behaviors related to motivation, better study skills, less anxiety or generalized worry about school performance, increased ability to recognize and record important information, better test-preparation strategies, and paying more attention to academic tasks, while the Low Achievement group reported more frequent use of support techniques or materials. One possible explanation for this pattern of scoring with regard to the Study Aides domain, may be related to the low achieving students’ need to seek out additional services, whereas the achieving (comparison group) students may not utilize additional support services to bolster already appropriate levels of performance. The groups were statistically equivalent in terms of perceived interpersonal skills, level of engagement in academic tasks, perceived importance of school, effective use of time, use of elaboration and organizational strategies to attach new information to prior knowledge and make information personally meaningful, and reviewing and preparing for class.

Findings for statistical differences in academic skills on the ACES between the Low Achievement and Comparison groups are consistent with Elliott and DiPerna’s (2002) findings. However, unlike Elliott and DiPerna, statistically significant differences were found for one of the Enablers subscales. These differences may be attributable to the number of low achieving students included in this study (101 compared to 30), as well as the use of “Low Achievement” (inclusive of low achieving and students with learning disabilities) compared to a more stringent inclusion criteria of “learning disabled” only. This finding is also consistent with DSM IV (APA, 1994) criteria for the
diagnosis of a Specific Learning Disability, in that achievement scores must be lower than expected.

Using the LASSI, Haynes et al. (1987) found that their low achieving sample differed significantly from their average and high achieving sample; the current study is generally consistent with these findings. In terms of the scale’s ability to discriminate between groups of students, Haynes et al. (1987) found that the Motivation, Selecting Main Ideas, and Time Management subscales were statistically significant, and of these three scales, Motivation was the best discriminator (Haynes, et al., 1987). For each of these scales, the Comparison group scored consistently higher, with the exception of Study Aides, in which the Low Achievement group obtained a higher average raw score. In the current study, Anxiety, Test Strategies, Concentration, and Study Aides were added to the list of discriminating variables, but Time Management was deleted. This provides further support for the LASSI’s discriminating power between extreme groups. However, as stated by Haynes et al. (1987), questions regarding the LASSI’s ability to discriminate among academically similar groups (i.e., Learning Disabled versus Low Achieving) remains to be determined. As well, the exact nature of differences between groups (i.e., which scales are most different) is in need of further investigation given the slight discrepancy in findings between the two studies.

In terms of practical application, while these findings were statistically significant, measures of practical significance (Eta-Squared) indicated small to moderate effect sizes. In other words, while there are certainly differences that are detectable at the group or composite level, the ability to use these instruments to detect profile differences on an individual basis is somewhat more limited.

**Analysis II**

Using step-wise discriminant analysis, the linear combination of Math/Science and Reading/Writing scales on the ACES were able to correctly classify 82.8% of the participants into Low Achieving and Comparison groups. Considered in the context of this particular study, the retention of these variables in the final model is not surprising. Specifically, approximately 32 percent of the students included in the Low Achievement group were referred for problems with mathematics, and thus self-reported lower math scores than the regular student population. Approximately five percent were referred for
problems with reading. Therefore, the premium placed on math scores in this model may be a direct result of the nature of referrals for testing observed among the low achieving student population. Finally, the linear combination of the Selecting Main Ideas, Anxiety, and Study Aides scales on the LASSI was able to correctly classify 79.9% of the participants into low achieving and comparison groups.

The first analysis essentially mirrored a study conducted in 2002 by Elliott and DiPerna, in which 76% of the students from the standardization sample were correctly classified into learning disability and non-learning disability groups using the ACES. The present study found an even higher classification rate, again lending credence to the claim that the ACES may be effective for differentiating between groups. However, the linear combination of variables in the Elliott and DiPerna study (2002) was not reported, making it impossible to determine which scales in their analysis accurately classified students into their respective groups. Preliminary analyses based on the findings of this study suggest that academic factors may be most effective in differentiating groups. While this suggests that assessing non-traditional academic factors may not be necessary as part of a diagnostic battery, it is consistent with diagnostic considerations from the DSM IV (APA, 1994).

The inclusion of all seven of the ACES scales in the simultaneous Discriminant Analysis did not increase the overall effectiveness of the model in the classification of students into their respective groups. In contrast, inclusion of all 10 scales from the LASSI increased the classification rate from 79.9% to 82.4%. Although there was very little practically significant change in the overall classification rates, the slight increase overall indicates that use of each of the instruments in their entirety is not only preferable in terms of clinical utility, but also acceptable in terms of statistical support. This point is of particular importance, as each of these instruments was designed to be implemented as a whole. Conversely, the relatively small change in overall classification rate when comparing the use of particular scales versus the entire instrument, also suggests that there is little practical utility in using all scales if the primary purpose of assessment is to differentiate between student groups.

Given that the classification rate was not 100% for any of the derived models, there are still unmeasured factors associated with differences between the groups that
could aid in correct classification, and provide further information regarding the core features that define and differentiate between these extreme student groups.

When considering both these analyses concurrently, the importance of academic skills (i.e., reading, math, writing) clearly emerges as a distinguishing factor between achievers and non-achievers. As well, issues related to affective maturity (i.e., anxiety), the ability to differentiate between important versus superfluous information (i.e., selecting main ideas), and the frequency of use of support techniques/services are consistently different between achievers and non-achievers. In contrast, while the MANOVA indicated significant differences between groups in terms of critical thinking skills, general study skills, and test-taking strategies, these variables did not emerge as key discriminators when separating students into groups. Clinically speaking, these findings continue to support the practice of putting emphasis on measures of general academic performance when determining who requires additional support. Additionally, these findings suggest that support services may need to broaden to include affective interventions to deal with emotional complicators such as anxiety.

Analysis III

Canonical correlations were derived for the set of ACES and LASSI variables. Two canonical roots emerged as being statistically and practically significant for interpretation. The first root accounted for approximately 63% of the variance shared between the variates; the second root accounted for 38% of the shared variance between the variates. The variables identified as being moderately correlated with the first canonical root were: Attitude, Motivation, Time Management, Information Processing, Self-Testing, Test Strategies, and Concentration from the LASSI, as well as Engagement, Motivation, and Study Skills from the ACES. Variables identified as fitting the second root included: Anxiety, Selecting Main Ideas, and Support Aides from the LASSI, as well as Reading/Writing, Math/Science, and Critical Thinking from the ACES.

The first root could be labeled a global factor, as well as a process factor. In other words, the subscales captured by this canonical root are characterized by self or goal-regulation strategies, are the actions that make a learner successful, and indicate readiness to engage college material. These may also capture “endurance” variables that relate to success in the long-term. What also clearly emerges is the close relationship between the
Enablers scale on the ACES and the majority of the scales on the LASSI. Examination of the items that comprise the Enablers scale, suggests that the Enablers scale may form a brief screener of several of the LASSI assessment areas. For example, there is a moderate correlation between the Attitude (0.50) and Motivation (0.67) scales on the LASSI with the Motivation scale on the ACES, demonstrating that the ACES is assessing a broader array of goal-directed behavior. Conversely, the broad assessment of the ACES may not tap the very specific aspects of goal-regulation assessed by the LASSI.

The second canonical root could be labeled a content domain, or a “skills” root. In other words, the subtests that represent this root are related to abilities, strategies, or the mechanics of successful learning. The relationship between the variables that comprise this variate is not entirely clear. Specifically, there is a clustering of academic skills, as well as the ability to discern important information, suggesting that the second factor is primarily academic in nature. However, inclusion of anxiety and use of support also suggests that there are affective and self-motivated strategies for success implicated in academic success.

As reported by DiPerna and Elliott (2002), the interpersonal skills subscale was virtually unrelated to any of the validity measures administered in previous research; however it was maintained in the analysis due to intuitive appeal and its relationship to the original instrument. The current analysis also provided little support for retention of the interpersonal skills variable.

The degree of overlap between these instruments, particularly in the Enablers domain for the ACES, supports the claim that these instruments are measuring similar constructs related to competence. However, the existence of two separate canonical roots also implies that there is some heterogeneity in these scales. The variable groupings may indicate two separate constructs at work within these instruments, or a multi-component definition of competence (as proposed by DiPerna and Elliott in 1999).

**Analysis IV**

As previously noted, difficulties during the data collection phase of this study precluded the use of the original regression models. The coefficient alphas for the ACES and LASSI competence measures were computed, and indicated moderate to high internal consistency of the contrived measure, lending support for use of these created
variables in the regression model. The coefficient alpha for the LASSI was particularly strong, suggesting that the scales that comprise the overall instrument are highly related and tapping a similar overall construct. Hierarchical linear regression for the combination of high school GPA, and ACES and LASSI competence scores, indicated significant contributions for prior high school GPA, as well as competence scores on the ACES. Comparatively speaking, in each model, the ACES accounted for more variance than the LASSI in terms of current semester GPA. This could be interpreted to mean that the ACES not only improves the predictive power of high school grades when examining current GPA, but also accounts for the variance explained by the LASSI. In other words, the ACES may be a better overall predictor of college performance above and beyond LASSI scores.

However, although the contribution of the ACES was statistically significant for each regression model, prior performance provided the larger proportion of explained variance (approximately 16%), indicating that it is a stronger predictor. The significant contribution of prior high school GPA is not surprising given the arguments that past academic performance is most predictive of current achievement levels, such as argued by Lawlor, Richman, and Richman (1997); Wilczenski and Gillespie-Silver (1992); McCausland and Stewart (1974); and DiPerna, Volpe, and Elliott (2002).

General Implications

It is the professional responsibility of school psychologists to have a profound understanding of how to most appropriately employ the measures we use to assess performance in students. Furthermore, the field of school psychology must continue to explore the accepted belief that true group differences exist and can or should be used to justify our differential approach to providing support services at the college level; if they are to continue to serve as gate-keepers to student assistance, they must be fully aware of how to best determine need for help. It is also imperative for other professionals (i.e., college admissions boards, student disability resource centers) as well to have a deeper understanding of the components of successful learning and to use that knowledge to improve overall service delivery.

To that end, this study was designed to investigate questions regarding the utility of the ACES – College and the LASSI, as well as the statistical and practical significance
of the information these instruments yield. Furthermore, this study aimed to explore what, if any, differences exist between student achievement groups with regard to performance on these measures, and discuss the practical implications of these differences.

Clearly, there are detectable differences between achievers and non-achievers at the group level, especially in terms of their self-reported academic abilities. This does not come as a surprise, as these students are most typically identified as struggling due to low grade point averages. Furthermore, the most salient discriminatory information is related to self-reported mathematical and reading/writing abilities, which is also consistent with the frequency of self-referrals for psychoeducational testing related to difficulties in these academic areas. Differences between groups were also detected with regard to emotive or behavioral factors related to learning, with anxiety and tools related to the engagement of academic material providing the most discriminatory data. Taken together, these findings suggest that detectable group differences do in-fact exist in the area of study skills or learning strategies; however, the differences are somewhat more conservative and scale-specific, leading one to question whether there are truly no differences between achievers and non-achievers on these constructs, or whether the ACES and LASSI simply could not detect these differences due to factors related to the flaws of this study (i.e., low observed power for these variables).

While the detection of statistical differences at the group level is exciting, the real-world application of this information in terms of practical significance is the true litmus test regarding test utility. Examination of the effect sizes for the findings indicated only moderate effects, meaning that professionals using these instruments may not be able to readily identify differences between achievers and non-achievers by simple examination of numerical data at the individual level. As well, not all of the data yielded by these instruments were identified as capable of making distinctions between groups, nor are there identifiable cut scores that clearly demarcate the point at which a student should be labeled a potential “non-achiever” or “low-achiever”. Therefore, decision-makers that use these instruments should exercise caution when looking at differences between students on the individual level, as low scores may not signify true or interpretable skill deficits. At the present time, the safest application of these instruments
in the context of access to service-delivery, admissions, or diagnostic decision-making appears to be in conjunction with other sources of data regarding scholastic performance. Stated another way, neither instrument should be used as a stand-alone diagnostic tool.

However, these findings do not justify discarding the use of either instrument at this time. Given the high level of correlation between the scales that comprise these instruments, it is also clear that they are measuring a common set of underlying constructs related to academic performance, and that these constructs are related to one another. Rather, there is a need to determine how to most appropriately use the data that these instruments yield. For example, rather than detecting group differences to discern who is entitled to support services, perhaps this information should be used to identify specific areas for remediation or skills that should be explicitly taught. Likewise, examination of these scales at the item-level may provide a way to rephrase the questions to provide more discriminatory information.

Findings regarding the ability for the ACES and/or the LASSI to predict grades at the college level were somewhat disappointing. Past performance (high school GPA) consistently emerged as the superior predictor of future performance, with the ACES adding comparatively little predictive information, and the LASSI providing even less. While the overall model including all three variables was statistically significant, only 20% of the variance in current semester GPA was captured by these variables, leading to questions of the practical significance of these findings. Furthermore, this also means that 80% of the variance was not explained. Again, this leads to questions regarding the utility of these measures, and college campus professionals are cautioned to use the data from these instruments only within the context of other known performance variables.

Summarily, the ACES and the LASSI are measuring similar underlying constructs, and show promise in their ability to differentiate between achieving and non-achieving groups of students. However, using these measures in isolation is not recommended as there are some questions regarding not only their ability to detect group differences at a practical level, but also the true existence of differences between student groups beyond that which is already self-reported through grades. Furthermore, this study was unable to answer the question regarding true identifiable differences between students who struggle and students with identifiable learning disabilities, and the ability
of these instruments to detect differences if they truly exist. In terms of performance prediction, these instruments, especially the LASSI, offer little clinical utility and may not be cost-effective alternatives to current decision-making models.

In terms of strengths and weaknesses for each instrument, the ACES Academic Skills scale was particularly useful when differentiating between achievers and non-achievers; however, this information can easily be obtained through examination of GPA rather than completion of the instrument. Furthermore information provided from the Enablers scale did little to separate student achievement profiles. At this time, the ACES may most appropriately be employed as a quick screener for potential academic problems. With regard to the LASSI, the internal scale structure indicates measurement of a single construct; however, only a few scales clearly emerged as effective in detecting differences between groups (if they truly exist), leading to questions regarding the retention of all 10 scales versus perhaps a total scale score.

**Limitations of the Study**

Several identifiable limitations were present in this study. The first limitation is related to sample size. Ideally, a larger sample of Low-Achieving students and students with Learning Disabilities should have been obtained to retain the original three-group analysis and provide further information about differences between these groups, if they truly exist. However, reduction of the three-group model eliminated potentially confounding effects related to question regarding true differences between low achieving students with and without learning disabilities. A second limitation, also related to sample size, speaks to the violation of multivariate assumptions. Many of the statistical procedures utilized were robust to such violations, nevertheless, their presence warrants caution in the interpretation of results. Furthermore, transformations of the data could have been performed to address issues of normality. Finally, a larger sample size would have accommodated cross validation procedures for several of the multivariate analyses conducted (i.e., Discriminant Analysis); due to the smaller sample available, these were not conducted.
Problems with obtaining similar standardized entrance exam scores were also present, thus eliminating the use of a standardized ability measure to be used as a covariate. The use of derived competence scores is somewhat problematic as these scores were obtained using nominal categories rather than interval data. Therefore, full representation of a range of scores for entry into the regression model was not possible. Furthermore, use of a composite score for the LASSI is counter to the author’s recommendation to avoid this practice (Weinstein, 1987).

The exploratory nature of the study, use of a volunteer sample, use of self-reported data for comparison subjects, and restrictions to generalizability due to subject demographics (e.g. demographic location) are also indicated as potential limitations to the study. Due to the exploratory nature of this study, significant findings should be considered preliminary and serve as a guide for future research. Replication of the study resulting in findings that support those of this study would provide further evidence useful in generalizing findings to similar populations. As well, the generalizability of the findings to other educational institutions is limited due to the unique characteristics of the sample, as well as the voluntary nature of the study. Additionally, given the high number of outliers (but not extreme values), it is also possible that participants attempted to skew their true responses to either appear more competent or more impaired (depending on the group to which they belonged), thus impacting overall findings.

**Future Research**

Additional investigation of the differences between students with Learning Disabilities and low achieving students is sorely needed in the field of school psychology. There is a history of evidence that there are few identifiable differences between these student groups; however, educational institutions at all levels continue to use these categorical groupings to determine who receives services. If we are to continue to work under the premise that there are true differences between low achievers and students with Learning Disabilities, then the profession should work toward identifying the instruments that provide the most discriminatory data. Therefore, not only should additional investigations be conducted using the current instruments, but also with other commonly
used diagnostic tools. Although this study suggests that there are detectable differences between self-identified low achieving and regular achieving college students, the exact combination of variables and their role is still uncertain, warranting caution in the use of this information when making eligibility determinations.

With regard to the ACES instrument, additional research should be conducted on the usefulness of the interpersonal scale as it relates to college students. With regard to the LASSI, further investigation of its diagnostic quality should be conducted. In other words, there are still questions with regard to the usefulness of the LASSI in differentiating between student groups. Specifically, low achieving students might have been predicted to consistently score below the 50\textsuperscript{th} percentile for all scales; however, this was not the case for the current analysis, leading to questions of its overall discriminability. For both instruments, further investigation of the underlying constructs or factor structures across instruments may provide more a more operational definition of competence. Perhaps investment into asking more in-depth questions regarding performance at the item-level may increase the utility of the data that these instruments provide. Conversely, consideration of a total score for both scales with clearly demarcated cut scores that differentiate achievers from non-achievers may be what is needed to increase instrument utility.
APPENDIX A

Human Subjects Approval Memorandum
Office of the Vice President
For Research
Tallahassee, Florida 32306-2763
(850) 644-8673 : FAX (850) 644-4392

APPROVAL MEMORANDUM
Human Subjects Committee

Date: 7/2/2003

Lauren Hutto
56 Guy Strickland Rd
Crawfordville, FL 32327

Dept.: Educational Psychology and Learning Systems

From: David Quadagno, Chair

Re: Use of Human Subjects in Research
A comparison of Two standardized Instruments for Measuring academic Competence in College Students with Learning Disabilities

The forms that you submitted to this office in regard to the use of human subjects in the proposal referenced above have been reviewed by the Secretary, the Chair, and two members of the Human Subjects Committee. Your project is determined to be exempt per 45 CFR § 46.101(b) 2 and has been approved by an accelerated review process.

The Human Subjects Committee has not evaluated your proposal for scientific merit, except to weigh the risk to the human participants and the aspects of the proposal related to potential risk and benefit. This approval does not replace any departmental or other approvals, which may be required.

If the project has not been completed by 7/1/2004 you must request renewed approval for continuation of the project.

You are advised that any change in protocol in this project must be approved by resubmission of the project to the Committee for approval. Also, the principal investigator must promptly report, in writing, any unexpected problems causing risks to research subjects or others.

By copy of this memorandum, the chairman of your department and/or your major professor is reminded that he/she is responsible for being informed concerning research projects involving human subjects in the department; and should review protocols of such investigations as often as needed to insure that the project is being conducted in compliance with our institution and with DHHS regulations.

This institution has an Assurance on file with the Office for Protection from Research Risks. The Assurance Number is IRB00000446.

Cc: Francis Prevatt
HSC No. 2003.325
APPENDIX B

Client and Control Consent Forms
Dear Client:

According to our records, you recently completed a psychoeducational evaluation at the Adult Learning Evaluation Center. As you are aware, our center not only evaluates students for a Specific Learning Disability, but also engages in research on a regular basis. The purpose of this form is to request consent for your participation in a specific research project entitled: “A Comparison of Two Standardized Measures for Evaluating Academic Competence in College Students with Learning Disabilities,” or “Academic Competence.” The aim of the research is to investigate the usefulness of both the LASSI and an additional measure that we are piloting for future use in our center. The instrument is the Academic Competence Evaluation Scales (ACES). This information will have no impact on your previous evaluation; however, the ACES can provide useful information regarding your skills in academic areas and non-academic areas such as study skills, interpersonal skills, academic engagement, and motivation.

If you are 18 or older, and consent to participate in this study, you will be asked to fill out the ACES and this consent form, and return it in the enclosed envelope as soon as possible. You will also be asked for permission to access your fall 2003 semester grades. Upon returning the ACES, your name will be entered into a lottery with other participants for a chance to win $100.00. In addition, you will be given feedback regarding the your responses on the ACES. You may withdraw your consent at any time should you change your mind about participating in this study, all we ask is that you return all forms. Please be assured that all information (e.g., test scores) will remain confidential to the extent allowed by law – we are only interested in group results, not individual scores. To ensure confidentiality, your file will be assigned an identification number that will be used in the data analysis. The link between your name and number will be destroyed at the completion of this study.

If you have any questions regarding this research or the results of your ACES scores, you are encouraged to contact the principle investigator, Lauren Hutto. You can reach Mrs. Hutto via email at hutto97@msn.com (please put “ACES Study” in the subject line). If you prefer, you may contact Mrs. Hutto at (850) 926-3214 in the evenings or you may contact her supervisor, Dr. Frances Prevatt, at (850) 644-9445 during business hours.

Please be sure to fill out the attached consent form and contact information so that we can reach you if you are the winner of our drawing! Good luck!

Thank you,

Lauren M. Hutto, B.S.
Florida State University
Doctoral Candidate
Combined Doctoral Program in Counseling Psychology and School Psychology
Consent Form

_____ I am 18 years or older, and hereby give my consent to participate in the study, Academic Competence. I have read the above information carefully and understand that I may withdraw my consent at any time. I also understand that I may contact the principle investigator to answer any questions that I have regarding the study or its results. Upon completing the requested forms, I will be entered into the $100.00 drawing.

_____ I am not interested in participating in this study and do not consent to completing the ACES – College. I understand that by not giving consent that this does not impact the results of my evaluation in any way, nor does it exclude me from services offered to other clients. I also understand that I will not be entered into the $100.00 drawing.

________________________________________  ______________________________
Client Signature  Date   Witness Signature  Date

Contact Information (for lottery drawing):

Name:

.................................................................

Phone:

.................................................................

Email:

.................................................................
Dear Student:

The Adult Learning Evaluation Center (ALEC) provides a variety of services to students at Florida State University, including assessment for Learning Disabilities and/or Attention-Deficit/Hyperactivity Disorder (ADHD), ADHD Coaching, and Study Skills Workshops. In addition, ALEC engages in research on a regular basis to gain a better understanding of how Learning Disabilities are manifested in adults and college students. The purpose of this form is to request consent for your participation in a specific research project entitled: “A Comparison of Two Standardized Measures for Evaluating Academic Competence in College Students with Learning Disabilities,” or “Academic Competence.” The aim of the research is to investigate the usefulness of two measures that we are using or anticipate using in our center. The instruments of interest are the Academic Competence Evaluation Scales – College (ACES - College) and the Learning and Study Strategies Inventory (LASSI). We are specifically looking for students (ages 18 or older) who are not struggling in their courses, have not been diagnosed with a ADHD, and do not suspect that they may have ADHD. We are also asking that you have a GPA of 2.5 or higher. If you have been diagnosed with a Learning Disability, please indicate that on the demographics form.

If you meet the above criteria, consent to participate in this study, and agree to allow us to access your end of semester fall 2003 grades, please sign below and complete the enclosed forms. These forms include a short demographic information form, the ACES – College, and the LASSI; upon completion your name will be entered into a lottery with other participants for a chance to win $100.00. The results from the ACES will not be available to instructors and will not impact your studies at Florida State University. However, it can provide you with useful information regarding your skills in academic areas (i.e., reading, math, and critical thinking ability) and non-academic areas such as study skills, interpersonal skills, academic engagement, and motivation.

You may withdraw your consent at any time should you change your mind about participating in this study. All information (e.g., test scores) will remain completely confidential to the extent allowed by law – we are only interested in group results, not individual scores. To ensure confidentiality, your file will be assigned an identification number that will be used in the data analysis. The link between your name and number will be destroyed following data collection. In addition, you will be given feedback regarding the your responses on the ACES; we will send you a report via mail.

If you have any questions regarding this research or the results of your ACES scores, you are encouraged to contact the principle investigator, Lauren Hutto. You can reach Mrs. Hutto via email at hutto97@msn.com (please put “ACES Study” in the subject line). If you prefer, you may contact Mrs. Hutto at (850) 926-3214 in the evenings or you may contact her supervisor, Dr. Frances Prevatt, at (850) 644-9445 during business hours.

Thank you,

Lauren M. Hutto, B.S.
Florida State University
Doctoral Candidate
Combined Doctoral Program in Counseling Psychology and School Psychology
Consent Form

_____ I am 18 or older, and hereby give my consent to participate in the study, Academic Competence. I have read the above information carefully and understand that I may withdraw my consent at any time. I also understand that I may contact the principle investigator to answer any questions that I have regarding the study or its results. Upon completing the requested forms, I will be entered into the $100.00 drawing.

_____ I am not interested in participating in this study and do not consent to completing the ACES – College. I understand that by not giving consent that this does not impact the results of my evaluation in any way, nor does it exclude me from services offered to other clients. I also understand that I will not be entered into the $100.00 drawing.

______________________________
Client Signature  Date

------------------------------------------------------------------------------------------------------------------
Contact Information (for lottery drawing):
(Please print)

Name:
_________________________________________________________________

Phone:
_________________________________________________________________

Email:
_________________________________________________________________
APPENDIX C

Demographic Information Form
Demographic Information
(To be kept separate from obtained data and destroyed upon completion of this project)

Please complete the following information. Your social security number is being requested so that we can confirm the information that you have given us regarding your school performance, and to allow us to get information regarding your GPA following this semester.

Name: _____________________________________________________________________

Social Security #: ____________________________________________________________

Class Designation (Circle one):

<table>
<thead>
<tr>
<th>Freshman</th>
<th>Sophomore</th>
<th>Junior</th>
<th>Senior</th>
<th>Other</th>
</tr>
</thead>
</table>

Diagnosed with a Learning Disability? (circle one)   Yes  No

Estimated High School GPA: ___________________________________________________

Current Estimated GPA: _______________________________________________________

College Entrance Exam Scores (specify test):_______________________________________

Phone Number: ______________________________________________________________
(or a number where you can be reached if you win the drawing)

E-mail address: ______________________________________________________________

Mailing address (to send your report): ____________________________________________
___________________________________________________________________________

How difficult do you perceive college-level classes to be?
1) Very difficult
2) Somewhat difficult
3) Occasionally difficult
4) Rarely difficult
5) Not difficult at all

How much effort do you feel you put into your college classes?
1) Very much effort
2) A lot of effort
3) Occasional effort
4) Some effort
5) No effort at all

How well do you think you are doing in college?
1) Far Above Average
2) Average
3) Variable
4) Somewhat below average
5) I am failing
REFERENCES


BIOGRAPHICAL SKETCH

Lauren M. Hutto
56 Guy Strickland Road
Crawfordville, Florida 32327
(850) 926-3214
hutto97@msn.com

EDUCATIONAL BACKGROUND

Doctorate of Philosophy
December 2004
Florida State University; Tallahassee, Florida
Combined Doctoral program in Counseling Psychology and
School Psychology – College of Education
Specialization in School Psychology

Bachelor of Science
May 1999
Florida State University; Tallahassee, Florida
Psychology – College of Arts and Sciences
Magna Cum Laude, with Honors

EXPERIENCE

FSU Multidisciplinary Evaluation and Consulting Center – Doctoral Psychology Intern
July 2003- August 2004 (Tallahassee, Florida)

Description: 2000 hour Doctoral level psychology internship. Responsibilities included:
• Autism evaluations (including interdisciplinary evaluations) using the Autism Diagnostic Observation Schedule, including multiaxial diagnoses
• Psychoeducational testing of pre-school and school-age children for Specific Learning Disabilities, Mental Retardation, Emotional Handicaps and Giftedness
• Supervision of practicum-level school psychology students
• Research in Autism
• Behavioral and academic consultation with teachers of students not receiving Exceptional Student Education services
• Behavioral consultation with teachers and parents of children with autism or autism spectrum disorders through the Center for Autism and Related Disabilities
• Group and individual counseling with middle school adolescents
• Interdisciplinary team assessments of Pre-Kindergarten students demonstrating developmental delays (Hamilton County, Florida)
• Weekly in-service training
• Parent-training workshops for parents of defiant and oppositional children
- Parent and school-level IEP meetings and interpretation of test results

Supervisors: Anne Selvey, Ph.D.; Ann Cituk, Ph.D.; Beverly Atkeson, Ph.D.; Michael McAuley, Ed.S.; David Breault, M.S.

FSU Multidisciplinary Evaluation and Consulting Center – School Psychology Intern
January 2003-June 2003 (Tallahassee, Florida)

Description: 600 hour Masters/Specialist level school psychology internship. Responsibilities included:
- Psychoeducational testing of school-age children for Specific Learning Disabilities, Mental Retardation, Emotional Handicaps and Giftedness
- Behavioral and academic consultation with teachers of students not receiving Exceptional Student Education services
- Participation in agency staff meetings and regular supervision
- Group and individual counseling with middle school adolescents
- Participation in school and district level IEP meetings and Child Study Teams
- Interdisciplinary team assessments of Pre-Kindergarten students demonstrating developmental delays (Hamilton County, Florida)
- Co-leader of psychoeducational group for school-age children with depression and bipolar disorder
- Weekly in-service training
- Placement: Medart Elementary School (Wakulla County, Florida) and various schools in Taylor County, Florida.

Supervisors: Anne Selvey, Ph.D.; Ann Cituk, Ph.D.; Beverly Atkeson, Ph.D.; Michael McAuley, Ed.S.; David Breault, M.S.

Tallahassee Memorial Behavioral Health Center – Psychological Evaluator
May 2002 – December 2002 (Tallahassee, Florida)

Description: Individual psychological assessment of inpatient and outpatient clients. Inpatient assessments primarily include work with adolescents admitted for violent or suicidal behavior. Assessments include psychoeducational and psychological batteries. Experience includes scoring protocols (i.e., MMPI-A, MCMI, Jesness), administration of tests, multiaxial diagnosis, and report dictation. The Rorschach is also administered; however, scoring is completed by a licensed psychologist.

Supervisor: Larry Kubiak, Ph.D.
Adult Learning Evaluation Center, Study Skills Workshop – Counseling Co-Leader  
*February 2002 – December 2002 (Tallahassee, Florida)*

**Description:** Didactic and counseling group experience. The purpose of the group is to improve or facilitate existing study skills related to college success. Groups meet weekly for eight weeks to learn about topics including organization, time management, note-taking, test preparation, anxiety and stress management, concentration, and motivation.

**Supervisor:** Briley Proctor, Ph.D.

FSU College of Education – Teaching Assistant (MHS 6938)  
*January 2002 – April 2002 (Tallahassee, Florida)*

**Description:** Assist in design of and instruction in a school consultation course. Included designing overall course project, weekly meetings with students, supervision of consultation projects, and final grading.

**Supervisor:** Briley Proctor, Ph.D.

FSU Career Center – Career Counselor/Advisor Trainee  
*August 2001 – December 2001 (Tallahassee, Florida)*

**Description:** Career counseling of self-referred community clients under supervision of a licensed psychologist. Included writing Individual Learning Plan, administering Self-Directed Search, Career Thoughts Inventory, and Card Sorts. Also served as a Career Advisor dealing with clients on a walk-in basis. Requires familiarity with resources available in career center, use of Career Key, use of Computer-Assisted Career Guidance Systems, and various other assessment instruments, as well as resume critiquing.

**Supervisor:** James Sampson, Ph.D.

Thomasville Family Counseling Center – Psychological Evaluator  
*June 2001 – Present (Thomasville, Georgia)*

**Description:** Psychoeducational testing of children in a private practice setting, to assist in making a DSM multi-axial diagnoses. Includes testing and integration of diagnostic checklists.

**Supervisor:** Christine Renaud, Ph.D.
FSU College of Education - Teaching Assistant (SPS 5192)
January 2001 – April 2001 (Tallahassee, Florida)

Description: Assist in teaching graduate level course on psychoeducational assessment.
Skills: Supervision and course organization. In-depth familiarity with the following assessment instruments:
- Woodcock-Johnson III Tests of Cognitive Abilities
- Woodcock-Johnson III Tests of Achievement

Supervisor: Briley Proctor, Ph.D.

FSU College of Education – Teaching Assistant (SPS 5191)
August 2000 – December 2000 (Tallahassee, Florida)

Description: Assist in teaching graduate level course on intelligence assessment.
Skills: Supervision and course organization. In-depth familiarity with the following assessment instruments:
- Wechsler Intelligence Scale for Children: Third Edition (WISC-III)
- Stanford-Binet Intelligence Scale: Fourth Edition (SB-IV)
- Wechsler Adult Intelligence Scale: Third Edition (WAIS-III)
- Wechsler Preschool and Primary Scale of Intelligence (WPPSI-R)

Supervisor: Briley Proctor, Ph.D.

FSU Adult Learning Evaluation Center – Psychological Evaluator
August 2000 – December 2002 (Tallahassee, Florida)

Description: Psychoeducational testing of adults and college-level students to determine presence of specific learning disabilities, learning problems, or Attention-Deficit/Hyperactivity Disorder. Includes assessment, report writing, individualized feedback and test interpretation.

Supervisor: Frances Prevatt, Ph.D.

FSU College of Education Human Services Center – Counselor Trainee
August 2000 – December 2000 (Tallahassee, Florida)

Description: Mental health counseling of self-referred community clients under supervision of a licensed psychologist. Includes treatment plan, case notes, summary notes, and group presentation.

Supervisor: William English, Ph.D.
FSU Multidisciplinary Evaluation and Consulting Center – Psychology Trainee
January 2000 – December 2002 (Tallahassee, Florida)

Description: Psychoeducational testing of school-aged children for Specific Learning Disabilities, Mental Retardation, Emotional Handicaps, and Giftedness. Includes work in the clinic and at schools. Also participated in IEP meetings and Child Study Team meetings.

Supervisor: Anne Selvey, Ph.D.

Cognitive Development Center - Trainer
November 1999 – May 2000 (Tallahassee, Florida)

Description: Providing auditory and visual training to children with processing deficits, difficulty in school, diagnosed disabilities, and disorders, as a means of improving task performance and enhancing school performance.

Supervisor: Robin VanWye, Ph.D.
RESEARCH EXPERIENCE

Comparing cognitive profiles of ASD and ADHD children  
*September 2003 – Present (FSU Multidisciplinary Center; Tallahassee, Florida)*

Description: Comparing the intellectual, behavioral, and adaptive skills profiles of students with Autism, Attention-Deficit/Hyperactivity Disorder, Specific Learning Disability, Mental Retardation, and No Diagnosis.

Effectiveness of counseling for children with depression and bipolar disorder  
*March 2003 - April 2003 (Children’s Medical Service; Tallahassee, Florida)*

Description: Collected pre and post-test data to examine the effectiveness of an eight week psychoeducational group counseling intervention for children with depression and bi-polar disorder.

Dissertation: Academic Competence  
*October 2002 – August 2004*

Description: Comparing the effectiveness of the Academic Competence Evaluation Scales – College and the Learning and Study Strategies Inventory in differentiating between learning-disabled, low-achieving, and typical college students, as well as the ability of these instruments to predict semester GPA.

Supervised Research: Cognitive Development Center  
*August 2000 – August 2002 (Tallahassee, Florida)*

Description: Investigation of the effectiveness of cognitive skills training with children diagnosed with specific learning disabilities and children with emotional or academic difficulties impacting school performance. Also investigates the generalization of success in the clinical and home environment to school performance.

RESEARCH PUBLICATIONS

CONFERENCES, WORKSHOPS, AND TRAINING SEMINARS

Clinical ADOS Workshop (sponsored by Emory Autism Center)
(Cathy Rice, Ph.D.) (August 2004, Atlanta, Georgia)

Autism Summer Institute (sponsored by FSU Center for Autism and Related Disabilities)
(June 2004, Tallahassee, Florida)

Administering and Scoring the Autism Diagnostic Interview – Revised
(FSU Center for Autism and Related Disabilities) (February 2004, Tallahassee, Florida)

Asperger syndrome: Clinical features, assessment, and intervention guidelines, and
highlights of current research
(Ami Klin, Ph.D.) (February 2004, Tallahassee, Florida)

Youth Violence and School Safety: Post 9/11 Coping with Crisis Lessons Learned
(Scott Poland, Ed.D.) (October 2003; Tallahassee, Florida)

Autism Summer Institute (sponsored by FSU Center for Autism and Related Disabilities)
(June 2003, Tallahassee, Florida)

Across the Spectrum: Autism, Asperger’s Disorder, and the PDD Spectrum
(Ami Klin, Ph.D.) (May 2003, Jacksonville, Florida)

Advanced Rorschach Interpretation and Integration with other Instruments
(Larry Kubiak, Ph.D.) (May 2003, Tallahassee, Florida)

Florida Association of School Psychologists
(November 2002, Jacksonville, Florida)

Florida Association of School Psychologists
(November 2001, Orlando, Florida)

Florida Association of School Psychologists
(November 2000, Miami, Florida)

Curriculum-Based Measurement – Florida Department of Education
(March 2000, Tallahassee, Florida)
PRESENTATIONS

Behavioral Strategies for Parents of Children with Challenging Behaviors
Co-Presenter
Leon County Schools – Hot Topics for Parents of Children in ESE (February 2004)

Defiant Children – Behavioral Strategies that Work! Four Part Series
Co-Presenter
Children’s Medical Service (September –December 2003)

Defiant Children – Behavioral Strategies that Work!
Co-Presenter
Children’s Medical Service (June, 2003)

Study Skills for Secondary and Post-Secondary Students
Co-Presenter
Florida Association of School Psychologists (November 2002)

Where Are They Now? Outcomes of College Students With and Without LD
Co-Presenter
Florida Association of School Psychologists (November 2002)

PROFESSIONAL ORGANIZATIONS/HONOR SOCIETIES

American Psychological Association
National Association of School Psychologists
Florida Association of School Psychologists
Florida Psychological Association
Pi Lambda Theta
SUMMARY OF ASSESSMENT EXPERIENCE:

• Academic Competence Evaluation Scales – College (ACES)
• Achenbach Child Behavior Checklist (CBCL)
• Achenbach Teacher's Report Form (TRF)
• Achenbach Youth Self Report (YSR)
• ADHD Rating Scale – Home Version and Classroom Version
• Asperger Syndrome Diagnostic Scale (ASDS)
• Autism Diagnostic Observation Schedule (ADOS)
• Bayley Infant Development Scales
• Behavior Assessment System for Children (Parent Rating Scale and Teacher Rating Scale) (BASC)
• Bender II
• Bracken Basic Concepts Scale - Revised
• Childhood Autism Rating Scales (CARS)
• Comprehensive Test of Phonological Processing (CTOPP)
• Detroit Tests of Learning Aptitude, Fourth Edition (DTLA-4)
• Developmental Profile II
• Diagnostic Test of Visual-Motor Integration (VMI)
• Differential Ability Scale (DAS)
• House, Tree, Person Drawing
• Kaufman Survey of Early Academic and Language Skills (K-SEALS)
• Key-Math
• Kinetic Family Drawing
• Learning And Study Strategies Inventory (LASSI)
• Lindamood Auditory Conceptualization Test (LACT)
• Peabody Picture Vocabulary Test (PPVT)
• Reynolds Adolescent Depression Scale (RADS)
• Reynolds Child Depression Scale (RCDS)
• Sentence Completion
• Stanford-Binet Intelligence Scale: Fourth Edition (SB IV) and Fifth Edition (SB V)
• Stanford Diagnostic Reading Test
• Suicide Inventory Questionnaire (SIQ)
• Thematic Apperception Test (TAT)
• Trauma Symptom Checklist for Children
• Universal Non-Verbal Intelligence Test (UNIT)
• Vineland Adaptive Behavior Scales - Interview Edition
• Wechsler Adult Intelligence Scale – Third Edition (WAIS-III)
• Wechsler Individual Achievement Test (WIAT)
• Wechsler Intelligence Scale for Children - Third Edition (WISC-III) and Fourth Edition (WISC IV)
• Wechsler Preschool and Primary Scale of Intelligence – Third Edition (WPPSI III)
• Wide Range Assessment of Memory and Learning (WRAML)
• Woodcock-Johnson Tests of Achievement - Revised (WJ R) and Third Edition (WJ III)
• Woodcock-Johnson Tests of Cognitive Abilities - Revised (WJ R) and Third Edition (WJ III)
• Young Children’s Achievement Test (YCIT)