The Academic Success Inventory for College Students: An Item Response Theory Analysis

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THE ACADEMIC SUCCESS INVENTORY FOR COLLEGE STUDENTS: AN ITEM RESPONSE THEORY ANALYSIS

By

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I dedicate this dissertation to my mother, Valerie Festa, because my success is a direct reflection of her sacrifice, love, wisdom, and strength. I also dedicate this degree to my grandparents, Raphael “Ray” and Gilda “Jill” Festa, for giving me the greatest gift, my family. I dedicate this manuscript and my successful defense to my uncle Al Fritsch because he fully understands the sacrifice and determination needed to achieve this degree. Finally, I dedicate this degree and all my future work to God, the ultimate Father, for making the impossible possible and making this longstanding dream finally come true.
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ABSTRACT

The aim of this study was to further validate the Academic Success Inventory for College Students (ASICS; Prevatt et al., 2011). There is a range of theoretical approaches related to academic success and there are several different academic success assessments, including traditional measures and nontraditional measures (Deci & Ryan, 2000; Harackiewicz, Barron, Tauer, & Elliot, 2002; Zimmerman, 1989; Astin, 1993; Tinto, 1993; Kuh, 2001a). However, there is a lack of sound, comprehensive instrumentation in the academic success literature. The ASICS (Prevatt et al., 2011) is a newly designed comprehensive, 50-item survey that is based on notable theories of academic success and empirical evidence. Research on the ASICS has already demonstrated sound psychometric properties in its early stages of development (Prevatt et al., 2011).

The present study used a Logistic Graded Response Model, which is a unidimensional IRT analysis, on each of the ASICS subscales. Based on Logistic Graded Response Model results, none of the items fit the expected or hypothesized model, which may be due to the lack of appropriate software. However, many of the items had appropriate item endorsement and discrimination, which provided information on what contributes to the ten factors measured by the ASICS. Even though it is in its early stages of development, the ASICS continues to have strong psychometric properties and is a sound measure of academic success. Many universities and colleges would benefit from utilizing the ASICS to help increase the academic performance and graduation rates of its students.
CHAPTER ONE

INTRODUCTION

The aim of this study is to further validate the Academic Success Inventory for College Students (ASICS; Prevatt, Li, Welles, Festa-Dreher, Yelland, & Lee, 2011). This manuscript will discuss the significance and importance of this study, its theoretical foundation, and current measures of academic success. In addition, there will be a review of test construction principles, the ASICS’s psychometric properties, and discussion of the ASICS’s utility. Finally, this study will propose the use of Item Response Theory to further analyze the ASICS and add to the literature on college academic success.

Social Significance

Graduating from college is a paramount stepping stone for individual achievement and future success (Pritchard & Wilson, 2003). There are several benefits to attending college and graduating with an undergraduate degree. For example, there is consistent evidence in the higher education literature that attaining a post-secondary degree is positively correlated with later employment and income (Pascarella & Terenzini, 2005). In addition to its economic benefits, higher levels of education appear to have an impact on a physical health (Cohn & Geske, 1992; Link & Phelan, 1995). College also affords individuals an additional opportunity to enhance their quality of life and worldview (Institute of Higher Education Policy, 1998). Tinto (1993) also asserts that college is not only an academic endeavor, but also is viewed as a rite of passage to young adulthood in Western society.

As a result of college’s significance and benefits, American society puts a large investment into higher education. Financially, the United States government devotes billions of dollars to fund post-secondary education (U.S. Department of Education, 2004). Approximately 17 million Americans are enrolled in college (Census Bureau, 2007b). Many Americans spend thousands of dollars to fund their own education with the hope of achieving a college degree (Department of Education, 2004). However, almost 50% of individuals who enter college will drop out before receiving their degree (Brawer, 1996). At least 15% of students who leave college do so as a result of a forced academic dismissal due to not meeting academic standards (Kalsner, 1991). Many students who are struggling academically end up leaving prematurely.
before a forced dismissal is warranted (Kalsner, 1991). Therefore, there is a great need to help students be successful at the post-secondary educational level.

Given the societal benefits and the significant financial investment Americans put towards higher education, student success at this level of education is paramount. Improving the academic performance of college students would not only help students receive a positive return on their educational investment, but would also positively impact society and the millions of Americans who enroll in college. Therefore, the educational and psychological fields should investigate factors that contribute to college academic success and develop tools to help increase retention and success rates.

**Statement of the Problem**

There are varying schools of thought and theoretical perspectives regarding the academic success of college students. These theoretical perspectives include Self-Determination Theory, Achievement Goal Theory, Self-Regulation Theory, Input-Environment-Outcomes Model (I-E-O), Student Integration Model, and Student Engagement Model (Deci & Ryan, 2000; Harackiewicz, Barron, Tauer, & Elliot, 2002; Zimmerman, 1989; Astin, 1993; Tinto, 1993; Kuh, 2001a). Each theory uniquely contributes to the academic success literature and highlights important factors related to academic success. Important factors that consistently occur throughout the academic success literature are motivation, study skills, concentration, self-efficacy, interest, and social influence.

As a result of the wide range of theoretical approaches, there are several different assessments of academic success, including traditional measures and nontraditional measures (Shivpuri, Schmitt, Oswald, & Kim, 2006). The traditional measures of academic success have great utility and are used nationwide (e.g., SAT, ACT, high school GPA; Hoffman & Lowitzki, 2005; Marsh, Vandehey, & Diekhoff, 2008). These measures tend to measure acquired knowledge and/or previous achievement. However, traditional measures of academic success only explain up to 25% of the variance in college GPAs (ACT, 1997; Camara & Echternacht, 2000; Robbins et al., 2004; Wolfe & Johnson, 1995). There are other factors that affect academic success and experts caution the use of traditional measures as sole predictors of future academic performance (Robbins et al., 2004).
In addition to the traditional and standardized measures of academic success, there are nontraditional assessments of academic success that tend to measure an array of factors associated with academic success that are not specifically measured by traditional assessments (e.g. LASSI, MSLQ, AMS, etc.; Shivpuri, Schmitt, Oswald, & Kim, 2006). Many of these assessments are based on a particular theoretical approach and measure important factors associated with academic success. Although the use of nontraditional measures is a valuable complement to the traditional measures of academic success, there is a lack of sound, psychometric instrumentation. In addition, the nontraditional measures tend to assess a limited number of factors, which limits the conclusions professionals can make about academic success. As a result, there is a need for a sound, comprehensive measure of academic success that can assess many of the academic success factors.

The Academic Success Inventory for College Students (ASICS) is a measure intended to assess the factors associated with college academic success (Prevatt, et al., 2011). The ASICS is a comprehensive survey that is based on notable theories of academic success and measures several pertinent factors. Research on the ASICS has demonstrated sound psychometric properties (Prevatt et al., 2011). The factor structure and evidence of construct validity has been established through empirical investigation (Prevatt, et al. 2011; Welles, 2010). However, as the measure is in its early stages of development, additional validation of the ASICS is warranted. To further validate the inventory, an item analysis should be conducted. Specifically, an Item Response Theory (IRT) analysis would help to refine the inventory and strengthen its psychometric properties. In addition, not only will an IRT analysis further validate the ASICS, it will also provide a more detailed understanding of academic success.

**Purpose of Study**

The purpose of the present study was to further examine and validate the psychometric structure of the Academic Success Inventory for College Students (ASICS; Prevatt et al., 2011) using an Item Response Theory analysis. This study will contribute to the research on the validity, reliability, and appropriateness of the Academic Success Inventory for College Students (Prevatt et al, 2011). The ASICS is a 50 item self-report survey that measures ten factors of academic success (i.e., General Academic Skills, Internal Motivation-Confidence, Instructor Efficacy, Concentration, External Motivation-Future, Socializing, Career Decidedness, Lack of
Anxiety, Personal Adjustment, and External Motivation-Current Time; Prevatt et al., 2011). Because there is limited research on the ASICS, information on the incremental utility of the scale would be beneficial for research and practical purposes. It would also be advantageous to investigate whether or not certain items are more discriminatory than others. Students who are more likely to possess the latent trait of academic success would more likely endorse “difficult” or discriminatory items. As a result of this information, survey items could be revised based on their appropriateness. This information will not only help validate and refine the Inventory, but will also provide a more detailed understanding of the different aspects of academic success and factors contributing to success in college. Given the exploratory nature of the current study, the following research questions will be proposed:

1. What is the degree of the individual item fit for the employed IRT model?
2. What are the item and category difficulties and their spread?
3. What are the discriminating properties of each individual item?
CHAPTER TWO

LITERATURE REVIEW

Academic success is a pertinent topic for most collegiate education and psychology programs. In today's society, graduating from college is a paramount stepping stone for individual achievement and future success (Pritchard & Wilson, 2003). Therefore, a student's performance during college can significantly affect his or her future outcomes. There are several reasons why completing a college degree and being successful during college is important. Among these reasons are financial outcomes, physical health, and emotional well-being. The following review will convey the importance of obtaining a college degree and maintaining good academic standing throughout one's collegiate career. In addition, the various theoretical perspectives of academic success as well as traditional and nontraditional measures of academic success will be discussed.

Significance of Academic Success in College

There is consistent evidence in the literature that involvement in post-secondary education is positively correlated with later employment and income (Pascarella & Terenzini, 2005). According to the U.S. Census Bureau (2002), individuals with a high school degree earn approximately half as much as an individuals with a college degree in one year. In regard to work-life earnings, this disparity remains constant and individuals with a college degree earn significantly more than individuals with a college degree (U.S. Census Bureau, 2002). Moreover, Pascarella and Terenzini (2005) state “a bachelor's degree holds a net occupational status advantage over a high school diploma of about .95 standard deviations (33 percentile points)…” (p. 535).

In addition to its economic outcome, having higher levels of education appear to have an impact on physical health (Link & Phelan, 1995). More specifically, individuals who obtain higher levels of education display better health regardless of income (Schnitker, 2004). According to Ross and Mirowsky (2010), research has shown that education also decreases age-related morbidity rates. The Cumulative Advantage Hypothesis suggests that educational attainment results in the development of effective habits and attitudes about physical health (Mirowsky & Ross 2005). Thus, more efficient health habits and attitudes result in better self-
care, more appropriate care of health problems, and less risky behaviors (Mirowsky & Ross, 2008, Pampel & Rogers, 2004; Ross & Wu, 1995).

Mirowsky and Ross (2005) believe that education increases personal control and empowers individuals to take a proactive role with their health. For example, a study by Pate, Pratt, Blair et al. (1995) found that individuals with higher educational attainment were more likely to following exercise recommendations outlined by the American College of Sports Medicine and the Center for Disease Control and Prevention. In addition, college education essentially eliminates the gender gap in physical capability where men and women with college degrees are generally similar in terms of physical health (Ross & Mirowsky, 2010). However, among individuals with lower levels of education, men have better physical health than women (Ross & Mirowsky, 2010).

Research has shown that educational attainment also impacts the physical health of one’s future generation or family lineage (Egerter, Braverman, Sadegh-Nobari, Grossman, & Dekker, 2009). A study performed by Egerter et al. (2009) found that as a mother’s educational level increased, her child’s overall health increased and early mortality rates decreased. However, the researchers above presume that it is the lifestyle or the nonmonetary benefits, such as psychological and social factors, that come with educational attainment that influences one’s health and the health of one’s family (Egerter et al., 2009).

Obtaining higher levels of education affords individuals additional benefits and opportunities to enhance one’s quality of life (Egerter et al., 2009). For example, individuals with higher level of education have a higher social status, increased sense of control, and more social support. Egerter et al. (2009) argue that these factors also improve one’s work conditions, subjective social status, professional mobility, and ability to handle life stressors. Mirowsky and Ross (1998) suggest that one’s quality of life improves due to the association between educational and healthy lifestyle practices. The authors state that education impacts one’s decision making, open-mindedness, attitude, analytic skills, and ability to make sound judgments. As a result, these opportunities and mindsets can improve one's quality of life and the life quality of his or her offspring (Mirowsky & Ross, 1998).

Current college enrollment

Given the various benefits of college, it is not surprising in today's society that there is a strong push towards completing a college degree. In fact, in 2006, approximately 17,232,000
students were enrolled in college (Census Bureau, 2007b). Of these students, 7,681,000 were enrolled at a 4-year institution and were taking a full course-load (Census Bureau, 2007b).

Some students feel that college is something they should start and complete immediately after high school. Actually, 66% of high school graduates who attend college start their post-secondary education right after high school. Therefore, it is not surprising that a significant number of college students are young adults. When looking at the young adult population nationally, approximately 37% of 18 year-olds to 24 year-olds reported they were attending college either full-time or part-time (Census Bureau, 2007a). To look at the age breakdown more specifically, 40% of 20-24 year-olds are enrolled in college (Census Bureau, 2007a).

Financial investment of college

Given the aforementioned benefits and the number of individuals striving for a college degree, it is not surprising that post-secondary education comes at a cost. According to the U.S. Department of Education, National Center for Education Statistics (2011), the average in-state tuition (including room and board) at a public 4-year institution for a full-time undergraduate student is approximately $15,014 per year. However, when taking in account both the cost of public and private schooling, the national average for the cost of college attendance is approximately $21,189 (U.S. Department of Education, 2011). This translates to costing approximately $84,750 for a bachelor’s degree completed in 4 years (U.S. Department of Education, 2011). Fortunately, a significant amount of financial aid is given each year to support students. The total amount of funds used to finance post-secondary education in the United States (including federal loans, state grants, institutional support, scholarships, etc.) equals approximately $149,001,000,000 for an academic year (U.S. Department of Education, 2004).

Graduation rates and completion of college

Although a great financial sum is invested into post-secondary education, graduation rates remain low. Approximately two million students drop out of college each year and nearly 30% of individuals who start college do not enroll for a second year of post-secondary education (American Institute of Research, 2010; Kitsantas, Winsler, Huie, 2008; U.S. Department of Education, 2004). A study conducted at a mid-western university by Cambiano, Denny, and De Vore (2000) found that only 41% of the freshman class graduated from their institution within six years and 5% were still enrolled after six years. Thus, this suggests that students are either dropping out of college, transferring schools, or being academically dismissed. Fortunately,
students from research universities have higher graduation rates of approximately 72.8%. This suggests that there is something unique about the research university's environment or the characteristic of students who attend research universities that increases the likelihood of graduation.

**Individual differences in academic success**

At least half of the variance in institutional retention is affected by the students themselves and their individual characteristics, not the educational environment (Astin, 1993, Zhang, 2009). One individual characteristic that has shown to effect graduation rates is ethnicity. Research has shown that Asian students have the highest graduation percentage (65.8%), followed by Caucasians (59.4%). Conversely, a majority of American Indians (60.8%) and Black students (58.8%) do not graduate within six years. In addition to ethnicity, ability, age, and economic status have been shown to influence graduation rates. For example, research has indicated that Caucasian females with high ability from a high social economic status (SES) have a greater probability of attaining a college degree than the remainder of the population (Zhang, 2009). In a study by Murtaugh, Burns, and Schuster (1999), the researchers found that retention improved with age, where freshman and sophomore students have the highest attrition rates. However, participation in Freshmen Orientation increased retention (Murtaugh, Burns, & Schuster, 1999). More specifically, non-resident students, with the exception of international students, had a higher rate of attrition. Therefore, age and living on-campus increases the likelihood of graduating.

**National academic performance**

Besides age, ethnicity, and residency, there are other individual factors that determine retention and attrition. Academic performance is a major determinant of retention. According to Kalsner (1991), 15% of students who leave college do so as a result of a forced academic dismissal. However, before even receiving an academic dismissal, many students end up leaving college because of the academic difficulties. Thus, it is necessary to succeed academically and perform well in order to reach the end goal of graduation. The U.S. Department of Education in 2004 assessed approximately 80,000 students from 1400 institutions and found that students reported the following grades: 16.9% mostly A's, 12.6% A/B's, 26.7% mostly B's, 15.9% B/C's, 18.7% mostly C's, and 9.3% C's and lower. Thus, the largest portion of students are reporting that they are receiving mostly B's, with mostly C's being the next largest portion, yet many are
receiving C's and lower. Given the social significance and financial investment of a college degree, it is surprising that there is not a larger number of students graduating and performing better academically. This brings to question the factors that attribute to academic success and graduation rates.

Summary of college in American society

Overall, college is a significant milestone for future life success (Pritchard & Wilson, 2003). There is strong evidence that success at college is positively correlated with employment, income, physical health, and quality of life (Institute for Higher Education Policy, 1998; Link & Phelan, 1995; Pascarella & Terenzini, 2005). As a result of a bachelor degree's significance, over 17 million students in the United States are enrolled in college (Census Bureau, 2007b). While reviewing the academic performance at the national level, there is an array of grade distributions (U.S. Department of Education, 2004), which brings to question the factors related to academic performance and success. Knowledge of the theories and factors behind academic success could increase achievement, retention, and graduation rates. Therefore, the following will discuss theories related to academic success.

Theories of Academic Success

It is important to review the theories that are most prevalent in the academic success literature. Each theory has a unique perspective related to academic success, thus addresses unique factors that relate to academic success. A comprehensive review of these theoretical perspectives can also provide an extensive review of factors shown to be related to academic success. Similarities between the different theories can also highlight factors that consistently appear throughout the academic success literature. In addition, this information will be beneficial for understanding the theoretical foundation behind some of the current academic success assessments and provide direction for the development of future assessments of academic success.

Self-Determination Theory

People have universal and innate desires to expand their interests and advance their natural abilities to grow as individuals (Deci & Ryan, 2002). As individuals grow, they begin to fulfill psychological needs and attain a sense of wholeness that matches their “true” self (Deci & Ryan, 2000; Deci & Ryan, 2002). However, individuals have the ability to reject these innate
desires and psychological needs (Deci & Ryan, 2000). Thus, it is more than just biological endowment that influences human growth, but the desire/motivation to advance as well (Deci & Ryan, 2000). Humans are either proactive or passive throughout their development, which is a dynamic process that is largely influenced by the social context (Deci & Ryan, 2002). In fact, the social-context can be viewed as the catalyst for motivation, which produces behaviors of personal growth (Ryan & Deci, 2000a). Moreover, the social environment influences within- and between-person differences in motivation, thus causing some people to be more self-motivated than others (Ryan & Deci, 2000a).

Self-Determination Theory (SDT) is based on the aforementioned perspective and encompasses a social-contextual view of psychological development and self-motivation (Deci & Ryan, 2000). SDT focuses on the environmental conditions or events, coupled with biological dispositions, which foster or prevent self-motivation (Deci & Ryan, 2000). Two sub-theories are produced from SDT that are interrelated, although they have distinct differences. One subtheory focuses on the essential needs of humanness while the other focuses on the continuum of motivation to meet these needs (Deci & Ryan, 2002; Ryan & Deci, 2000a). Thus, it is important to address the needs that are universal motivators ingrained in all humans (Deci, Vallerand, Pelletie, & Ryan, 1991). In academic success research, knowledge of these innate needs and motivational types brings awareness to contextual factors that could facilitate desire and performance (Deci, Vallerand, Pelletie, Ryan, 1991). Therefore, both of the SDT sub-theories are important to discuss in academic performance research and are reviewed below.

Cognitive Evaluation Theory. Cognitive Evaluation Theory categorizes human needs into three broad areas: autonomy, relatedness, and competence. Competence is feeling efficacious in an environment that gives an individual the opportunity to demonstrate his or her skills (Deci & Ryan, 2002; Deci, Vallerand, Pelletie, & Ryan, 1991). Thus, competence is expressed by one's feelings about his/her skill or ability, not one's actual achievement or success in performance (Deci & Ryan, 2002). Similarly, autonomy can be viewed as volition or possessing an internal locus of control where behavior is self-initiated (Ntoumanis, 2005; Ryan & Deci, 2000c). Thus, the individual does not feel as a 'pawn' but as the originator of his/her actions (Ryan & Deci, 2000c). Although there is a desire for autonomy, there is also a need for relatedness, which is accruing meaningful connections with other individuals (Deci, Vallerand,
Pelletie, & Ryan, 1991). The need to be integrated with others is not outcome or status driven; however, it is a need to be in a secure environment (Deci & Ryan, 2002).

The innate psychological needs are feeling based. Achievement of these needs is obtained as long as the individual feels he or she is competent, autonomous, and related/connected in his or her social context. According to Cognitive Evaluation Theory, the factors of autonomy, relatedness, and competence help explain variability in intrinsically motivated behaviors, which will be discussed below (Ryan & Deci, 2000b).

**Organismic Integration Theory.** The type of motivation behind a behavior or action can often impact one's experience and/or performance (Ryan & Deci, 2000c). Extrinsic motivation refers to activities one performs for a separable outcome (Ryan & Deci, 2000a; Ryan & Deci, 2000c; Ryan & Deci, 2000b). Extrinsically motivated behaviors are viewed as instrumental in gaining an external consequence (Deci, Vallerand, Pelletie, & Ryan, 1991). For instance, an college student who is extrinsically motivated studies hard for a final exam in order to get approval from others (Deci, Vallerand, Pelletie, & Ryan, 1991). On the other hand, an activity one performs out of inherent satisfaction is called intrinsic motivation because these behaviors have an internal locus of control (Deci, Vallerand, Pelletie, & Ryan, 1991). For example, a college student who studies out of interest for the subject matter is intrinsically motivated (Deci, Vallerand, Pelletie, & Ryan, 1991). In early research, the two types of motivation were believed to be polar opposites, where extrinsic motivation was viewed as lacking self-determination (Deci & Ryan, 2002). However, more recent literature suggests that this is not the case. In fact, research has demonstrated that extrinsically motivated behaviors can be on a continuum ranging from being controlled by external factors to internal/self-determined factors (Deci, Vallerand, Pelletie, & Ryan, 1991; Ryan & Connell, 1989).

Extrinsic motivation continuum. According to SDT, extrinsic motivation is on a continuum from external, introjected, identified, to integrated regulation (Deci & Ryan, 1985). The concepts of internalization and integration determine the difference between the different types of extrinsic motivation (Deci, Vallerand, Pelletie, & Ryan, 1991). Internalization is when externally controlled behaviors become internally regulated behaviors (Deci, Vallerand, Pelletie, & Ryan, 1991).

According to Deci et al. (1991), external regulation occurs when a behavior is performed due to external stimuli or elements. A child receiving an external reward (e.g., candy) for a
positive behavior or punishment (e.g., time-out) for a negative behavior is an example of external regulation (Deci et al., 1991). Another example is a high school student who is forced by his or her parent to read over his or her biology textbook and, as a result, has little retention of the information because the subject has no importance to him or her (Deci, Ryan, & Williams, 1996). Thus, the student had not internalized the subject matter or had no desire to study, and in fact was purely externally motivated (Deci, Ryan, & Williams, 1996).

When the individual starts to internalize demands and is pressured to behave due to punishment or reward is introjected regulation (Deci et al., 1991). For example, a honors student who studied because "she felt like she had to" is regulated by introjects or "shoulds" (Deci, Ryan, & Williams, 1996).

When a person values a behavior and identifies with its purpose is identified regulation (Deci et al., 1991). For example, a pre-med student who willingly studies for his or her biology courses because it is important for getting into medical school has identified regulation motivation (Deci et al., 1996). Integrated regulation occurs when the activity is fully assimilated into the self and behaviors are similar to one's values and needs (Deci & Ryan, 2002; Ryan & Deci, 2000b). For example, a biology student who studies hard for a biology exam because she is an “animal lover” and is an aspiring veterinarian has an integrated regulation. The student has identified the behavior with other aspects of herself (i.e., animal lover), but is still outcome orientated (i.e., her desire to become a veterinarian; Deci et al., 1996).

Intrinsic motivation. Intrinsic motivation is the human inclination towards assimilation, mastery, and interest in order to achieve enjoyment and human development (Csikszentmihalyi & Rathunde, 1993; Ryan, 1995; Ryan & Deci, 2000b). Activities that promote pleasure, interest, and challenge tend to foster intrinsic motivation (Deci & Ryan, 2002). For example, a student who audits an exercise science course because his or her hobby is exercising is intrinsically motivated to sit-in the class. Intrinsic motivation differs from integrated regulation because the actions are performed spontaneously and are done out of pure interest and enjoyment (Deci & Ryan, 2002). However, integrated regulation behaviors are performed as a result of personally important outcomes and are done purposefully (Deci & Ryan, 2002).

Amotivation. The initiation of behavior can fall on a continuum of motivation from intrinsic motivation to external regulation motivation (Ryan & Deci, 2000b). On the other hand, amotivation, which is neither extrinsically nor intrinsically motivated occurs when someone is
lacking the desire to act (Ryan & Deci, 2000b). When an individual does not value a behavior or outcome, he or she can be amotivated (Ryan & Deci, 2000b).

**Cognitive Evaluation Theory and academic success.** Self-Determination Theory focuses on one's interest in learning, increasing one's value of education, and increasing one's self-confidence and efficacy (Deci & Ryan, 1991; Deci et al., 1991). Sheldon and Krieger (2007) assert that the facilitation of competence, relatedness, and autonomy (i.e. the human psychological needs) in education results in higher subjective well-being, better academic performance, and more motivation for pursuing a future career. On the other hand, students with unmet needs experience decreased psychological well-being, poorer academic performance, and less motivation in pursuing a future career (Sheldon & Krieger, 2007). Hardre and Reeve (2003) investigated the difference between the three human needs (i.e., autonomy, competence, and relatedness) and found perceived competence to be the most reliable predictor of GPA. Some researchers believe that autonomy is the most common basic need associated with academic success (Fortier, Vallerand, & Guay, 1995).

Research has shown that school-aged children who reported more autonomy had a better conceptual understanding and memory of the presented material (Grolnick & Ryan, 1987; Grolnick, Ryan & Deci, 1991). In regards to college, Black and Deci (2000) discovered that, at the start of a course, one's initial level of autonomy is associated with the probability of dropping out. More specifically, the more autonomously motivated a student is when starting a course, the more likely he or she is to remain in the course as well as adjust to the course demands (Black & Deci, 2000). On the contrary, Black and Deci (2000) discovered that if students view their instructor as someone who encourages autonomy, they performed better in the course.

**Organismic Integration Theory and academic success.** A greater body of the Self-Determination Theory literature focuses on the Organismic Integration Theory as it relates to education. Research suggests that learning is strongly influenced by intrinsic motivation, specifically one's interest in the subject (Ryan, Connell, & Plant, 1990; Jones, Llancer-Arrastia, & Newbill, 2009). Moreover, a study by Schiefele (1991) found interest to be positively correlated with deep processing and quality of learning. In a more recent study, Jang (2008) investigated whether giving a rationale for performing an uninteresting lesson would increase internalization of the task. The control group worked on the task without a rationale of the task's
purpose (Jang 2008). The “findings showed that an externally provided rationale, when delivered in an autonomy-supportive way, promoted a relatively high-quality learning experience for participants, as assessed by their motivation, engagement, and conceptual learning” (Jang, 2008, p. 806). Thus, when a task is interesting, has a purpose, or is internalized, individuals have a better learning experience.

Much of the research has shown that intrinsic motivation and integrated regulation have a relationship with quality learning and personal adjustment (Deci et al., 1996). For example, students who learn the course information for the future display a better understanding of the course materials because they possess higher levels of intrinsic motivation (Benware & Deci, 1984). Burton, Lydon, D'Alessandro, and Koestner (2006) found an association between identified regulation and achievement and an association between identified regulation and effort. Aside from academic performance, students who remain in college have higher amounts of intrinsic motivation, identified regulation, and integrated regulation (Vallerand & Bissonnette, 1992). However, some critics suggest that the American education system's inherent use of performance evaluations (e.g. grades) can undermine intrinsic motivation, conceptual learning, and creativity (Benware & Deci, 1984).

**Achievement Goal Theory**

Motivation is a key factor in predicting academic success (Harackiewicz, Barron, Tauer, & Elliot, 2002). In the motivation research, goals are generally defined in terms of performance standards or outcomes (Urdan & Maehr, 1995). Achievement goals are specific and related to what a student hopes to accomplish academically. As such, these goals influence a student's approach to college (Harackiewicz & Elliot, 2002; Ames, 1992b; Dweck, 1986; Nicholls, 1989). Achievement Goal Theory asserts that one's behavior related to achievement and motivation can be explained by the reasoning behind performance (Wolters, 2004). This framework stems from a social-cognitive perspective and focuses on how students view their task, performance, and themselves (Ames, 1987; Midgley, Maehr, & Urdan, 1993). Thus, Achievement Goal Theory focuses on the student's perception of why they are achieving rather than what they are trying to accomplish (Wentzel, 1993).

In early achievement goal research, goals were conceptualized in two forms: task goals and ability goals (Urdan & Maehr, 1995). According to past research, task goals relate to the student's need for mastery. Ability goals relate to the student's desire to demonstrate his or her
ability based on normative standards of performance (Ames, 1992a; Dweck & Legget, 1988; Urdan & Maehr, 1995). As achievement goal research advanced, the operational definitions of achievement goals were refined and became more specific. The term task goal was redefined as a mastery goal and the term ability goal was redefined as a performance goal (Harackiewicz, Barron, Pintrich, Elliot, & Thrash, 2002). Goals that are self-referential and focus on self-improvement, skill development, and learning are defined as mastery goals (Eccles & Wigfield, 2002; Harackiewicz, Barron, Pintrich, et al. 2002; Harackiewicz, Barron, Tauer, Carter, & Elliot, 2000). For example, individuals with mastery goals may ask questions such as “how can I do this task?” and “what will I learn?” (Eccles & Wigfield, 2002). Performance goals are defined as normative and are based on the demonstration of competence/ability and out-performing others (Harackiewicz et al., 2000; Harackiewicz, Barron, Pintrich et al., 2002). For example, an individual who has performance goals may ask questions such as “will I look smart?” or “can I outperform others?” (Eccles & Wigfield, 2002). Previous studies have indicated a relationship between adaptive learning behaviors and mastery goals (Harackiewicz et al., 2000). On the contrary, performance goals may be linked to maladaptive learning behaviors, which often have a negative impact on learning (Harackiewicz et al., 2000). In some cases, performance goals are associated with positive outcomes. However, inconsistencies regarding the impact of performance goals suggest that the definition of performance goals may be too broad (Harackiewicz et al., 2000).

The current research on goal orientations has advanced and includes performance-approach, performance-avoidance, mastery-approach, and mastery-avoidance orientations (Pintrich, 1999; Wolters, 2004). Goals with the function of attaining favorable judgment from others through publically demonstrating one's ability are called performance-approach (Harackiewicz, Barron, Tauer et al., 2002; Wolters, 2004). Mastery-approach goals overcome challenges and increase competence (Harackiewicz, Barron, Tauer et al., 2002). Avoiding unfavorable judgment or appear incompetent is considered a performance-avoidance goal (Harackiewicz, Barron, Tauer et al., 2002; Wolters, 2004). Mastery-avoidance goals focus on working to avoid lack of learning or competence (Harackiewicz, Barron, Tauer et al., 2002).

**Achievement Goal Theory and academic success.** Research has shown that goals impact academic performance and interest (Harackiewicz, Barron, Tauer et al., 2002). However, it is unclear which goal orientations have the most significant impact on achievement, especially
when considering multiple-goals (Daniels, Hayes, Stupnisky, Perry, Newall, & Pekrun, 2009). A study conducted by Valle et al. (2003) investigated the types of goals college students employed during their post-secondary education. The results revealed a majority of students used multiple goal combinations (mastery and performance), followed by performance goals only, and then learning goals only (i.e., mastery goals; Valle et al., 2003). This study, however, did not indicate how these goals relate to achievement (Valle et al., 2003).

Previous research has demonstrated that students who perform well in school tend to use performance-approach goals (Barron & Harackiewicz, 2001; Harackiewicz et al., 2000). A meta-analysis conducted by Linnenbrink-Garcia, Tyson, and Patall in 2008 found that at least 40% of the literature they reviewed found mastery goals to have a strong influence on achievement (Daniels, Stupnisky, Pekrun, Haynes, Perry, & Newall, 2009). In addition, mastery goals had moderate correlations with interest and enjoyment. In a longitudinal study of college students by Harackiewicz, Barron, Tauer et al. (2002), performance goals predicted overall GPA and GPA in all psychology courses and mastery goals predicted continued interest in psychology seven years later. Thus, the researchers suggest the use of both goals for long-term success since they predict different forms of academic success (Barron & Harackiewicz, 2003; Harackiewicz, Barron, Tauer et al., 2002).

A study conducted by Daniels et al. (2009) found no significant difference between performance goals, mastery goals, and the use of multiple goals as they relate to two forms of achievement: overall GPA and final grade in an introductory psychology course. Even though there were no differences in academic outcome, the students' experience may vary depending on his or her goal-orientation (Pintrich, 2000). For instance, mastery goals can create feelings of interest and performance goals can create a sense of pride (Pekrun, Elliot, & Maier, 2006; Harackiewicz, Barron, Carter, Lehto, & Elliot, 1997).

Self-Regulation Theory

Self-Regulation Theory focuses on how students master learning (Zimmerman, 2008). Social cognitive theory is the theoretical basis of Self-Regulation Theory and views self-regulation as a set of psychological sub-functions that students use to control motivational, affective, and social factors associated with their intellectual functioning (Zimmerman, 1986, 1990; Bandura 1986, 1991; Mousoulides & Philippou, 2005). Self-Regulation Theory is a social cognitive perspective that combines social, environmental, and self-influences and demonstrates
how they relate to the thoughts, feelings, and actions one uses to attain a goal (Zimmerman, 2000).

According to Self-Regulation Theory, self-regulated learning is self-directed methods one uses to acquire an academic skill (Zimmerman, 2008). More specifically, self-regulation is a process that involves the individual monitoring their cognitions, behaviors, and motivation so he or she can reach his or her goals (Pintrich, 1999). Self-regulated learners note when they do or do not possess a skill and/or knowledge (Pintrich, 1999, Zimmerman, 1990). In fact, they take responsibility for their learning by approaching learning in a systematic, controlled, and planned manner (Zimmerman, 1990). Moreover, a feature of the Self-Regulation Theory is a “self-oriented feedback loop”, which is a cyclical process where the student monitors, receives feedback, and then adapts their learning strategies (Carver & Scheier, 1981; Zimmerman, 1989). Unlike a closed or controlled loop model that only focuses on negative feedback (i.e., reducing the difference between desired goal and current observations), social cognitive perspective views self-regulation as a positive feedback loop (i.e., continually raising or increasing desired goals based on current observations; Zimmerman, 1990).

**Self-regulation strategies.** Many studies have investigated how the various metacognitive/cognitive, motivational, and behavioral strategies relate to learning and academic performance (Zimmerman, 1990). Metacognitive strategies include awareness of one's cognitions and his/her planning, monitoring, and regulation of cognition as it relates to learning (Pintrich & De Groot, 1990; Somuncuoglu & Yildirim, 1999). Cognitive strategies can occur on two levels (i.e. deep or superficial) and include receiving, retrieving, encoding, and organizing information (Young, 2005). Deep strategies encourage long-term retention through various skills, such as elaboration, organization, and critical thinking. Superficial strategies encourage short-term memory and encoding of new information through various skills, such as rote memorization and highlighting key points (Pintrich, 1988). Behavioral factors/approaches of self-regulation focus on more tangible outcomes or actions (Mace, Belfiore, & Shea, 1989). Young (2005) asserts that students need motivational factors in order to learn, such as goal-setting and belief in one’s abilities. Students must be motivated to perform and behave as self-regulated students (Pintrich, 1988, 1989). Some experts believe motivational factors are the momentum behind the other factors (Rothstein, 1990; Woolfolk, 1990; Young, 2005). For
instance, research has shown that motivation and self-efficacy have strong associations with academic performance and self-regulation (Schunk & Zimmerman, 1994).

As a result of the early studies of self-regulated learning, a significant number of instruments were developed to assess the self-regulation concepts, such as the cognitive, motivational, and behavioral constructs (Zimmerman, 2008). These instruments include the LASSI (Weinstein, Schulte & Palmer, 1987), MSLQ (Pintrich, Smith, Garcia, & McKeachie, 1993), and SRLIS (Zimmerman & Martinez-Pons, 1988) and will be discussed in more detail below. Winne and Perry (2000) classified the aforementioned assessments as aptitude measures of self-regulation because they assess relatively enduring attributes that predict future behavior, by using ratings associated with time or typical behavior (Zimmerman, 2008). These assessments have been directly or indirectly related to self-regulation and have been used to assess academic performance. These measures will be discussed later in the nontraditional measures of academic success section.

**Self-regulation and academic success.** Research has shown a positive relationship between self-regulation and academic success (Pintrich & De Groot, 1990). As one's self-regulation increases so does one's academic performance (Nota, Soresi, & Zimmerman, 2004). Zimmerman and Martinez-Pons (1988) assert that self-regulation was the best predictor of standardized achievement test scores as compared to gender and socioeconomic status. Although there are various forms of self-regulation strategies (i.e., metacognitive, motivational, and behavioral), research has shown that if an individual possesses at least one self-regulation factor this would predict a significant amount of his or her standardized test scores (Zimmerman & Martinez-Pons, 1988). Furthermore, the implementation of instruction that encourages self-regulated learning has significantly increased mean achievement scores as well as use of self-regulation strategies among students (Paterson, 1996).

Studies have shown that achievement/academic success is influenced by a student's use of various self-regulation strategies, such as evaluating, self-monitoring, and planning (McCaslin & Hickey, 2001; Pintrich & DeGroot, 1990; Sundre & Kitsantas, 2003; Zimmerman, 2001; Zimmerman & Schunk, 2008). A study by VanZile-Tamsen and Livingston (1999) discovered that students who have poor academic performance possess significantly less self-regulated learning than students who performed well academically. Moreover, a longitudinal study by Nota, Soresi, and Zimmerman (2004) demonstrated that the cognitive strategies of organizing
and transforming information were significant predictors of one's high school GPA and GPA for the first two years of college. Students who displayed greater use of these strategies also significantly passed more examinations during their first two years of college and had significantly higher GPAs (Nota, Soresi, & Zimmerman, 2004). Experts have also investigated the motivational strategy of self-consequences, and found it to be a predictor of HSGPA and a student's desire to attend college. A study by Zimmerman and Martinez-Pons (1986) found that students with poor academic performance used less of self-regulated techniques, including seeking information, monitoring, reviewing notes, and goal-setting. Thus, academic institutions may want to teach low achieving students how to use self-regulation strategies so that these strategies can improve their academic performance (VanZile-Tamsen & Livingston, 1999).

**Input-Environment-Outcomes Model (I-E-O)**

The Input-Environment-Outcomes Model is used as a conceptual framework for understanding academic success based on a cause and effect model (Zhao, 2003; Bitzer & Troskie-De Bruin, 2004). The I-E-O model is focused upon three variables: input, environment, and outcomes. Inputs are referred as personal characteristics that the student possesses before he or she enters college. For example, motivation, cognitive ability, and past experiences would constitute as “inputs” (Swing, 2001). Environment refers to the student's college experience while at his or her institution (Swing, 2001). These experiences include academic and nonacademic aspects of college life, such as involvement with student organizations, programs, classes, faculty members, peers, work, etc (Swing, 2001). Outcomes refer to the change and growth in the student after being exposed to the environment (Swing, 2001). For example, content knowledge, ability, skills, and social development can be categorized as "outcomes" (Swing, 2001). In sum, input is what the student has before college, environment is the experience of college, and outcome is what the student gains or how their characteristics have changed after his or her college experience (Zhao, 2003; Bitzer & Troskie-De Bruin, 2004).

The I-E-O model is unique in that it captures the interactional process of academic success in a simple and easy to understand framework (Kelly, 1996). The Input-Environment-Outcome facets are not independent concepts, but have interactions among each other (Swing, 2001). For example, a student with an average cognitive ability works hard throughout college, seeks faculty support, and graduates college with honors. Thus, the student's input (i.e., ability) coupled with his or her environment/experience produced the outcome of success (i.e.,
gr graduating with honors). Moreover, the student's good foundation of innate ability continually assists the student while he or she performs/works academically to have success (Swing, 2001). Within the I-E-O model, success is mostly determined by the quality of the college experience (Swing, 2001). In many longitudinal studies, the focus tends to be on students' involvement in social activities, academics, and other formal/informal activities as a pivotal determinate of success (Swing, 2001). As described above, the student's input on its own did not solely produce success; rather, a combination of ability and environment working together produced success (Swing, 2001). In addition, the environment is composed of, not only of the academic environment, but the social and institutional environment as well (Swing, 2001).

Overall, the I-E-O model provides more of a cause-and-effect approach to academic success (Zhao, 2003; Bitzer & Troskie-De Bruin, 2004). The student has pre-existing knowledge, abilities, and characteristics before they enter college (Zhao, 2003; Bitzer & Troskie-De Bruin, 2004). The student enters college and the aforementioned traits are modified/enhanced as a result of the new experience and exposure to novel information (Zhao, 2003; Bitzer & Troskie-De Bruin, 2004). Once college is completed, there is an outcome of success or failure (e.g., graduation, early dismissal, overall GPA, etc.; Zhao, 2003; Bitzer & Troskie-De Bruin, 2004).

**Student Integration Model**

Tinto's Student Integration Model has been used to explain college student attrition, retention, academic performance, and integration into the college experience (Cabrera, Nora, & Castañeda, 1993). In fact, the Student Integration Model is a prominent framework in the study of college retention and attrition (Zhao, 2003). In general, Tinto asserts that the more a student integrates into his or her college experience, the greater chance a student has to be successful in college (Thomas, 2000).

The Student Integration Model is based on the past works of Durkhiem (1951) and Van Gennep (1960). According to Durkhiem (1951), suicide in Western culture is a result of individuals failing to integrate into society. Van Gennep (1960) was a researcher who focused on initiation rites that individuals go through in order to advance their status or maturity. Tinto takes into account these two perspectives of social integration into his model of college student integration (Thomas, 2000). Tinto asserts that college represents a Western societal rite of passage from adolescence to adulthood (Tinto, 1993).
Tinto's model suggests that college students must physically and socially dissociate from their home communities to assimilate with their college community (Tierney, 1999). In essence, the student has to depart and detach from their past environments in order to avoid early departure from college (i.e., attrition). Tinto views attrition or leaving one's institution and not completing a bachelor's degree as “academic suicide” (Tinto, 1993). Therefore, Tinto also focuses on within-institution peer cultures as a determinant of student success (Thomas, 2000). For instance, students at a residential institution have a greater probability of graduating from their institution than students at a commuter college (Tierney, 1992). In the Student Integration Model, in order to be successful, students have to connect to a peer group(s) in order to fully assimilate into their college environment (Tinto, 1993). Students socially connecting to their college environment will increase their likelihood of retention and increase their probability of success (Tinto, 1993). Thus, the Student Integration Model focuses more on the student integrating into the college social environment in order for the student to mature and advance. Graduating college illustrates success and completion of the rite of passage into adulthood.

**Kuh's Student Engagement Model**

Kuh's Student Engagement Model differs from the I-E-O model in that it does not take into account previous experiences or characteristics that students possess prior to the college experience. In fact, Kuh asserts that the most important factor related to academic success is what students do during their college experience, not what they bring with them (Bitzer & Troskie-De Bruin, 2004). According to Kuh (2001a), the best predictor of academic success is the amount of time students put towards academically related activities, which he defines as academic engagement.

Institutions that create an environment that fosters academic engagement have higher graduation rates (Bitzer & Troskie-De Bruin, 2004). According to Kuh (2001b) certain institutional practices foster student engagement. For instance, Kuh supports Chickering and Gamson's (1987) recommendations in their "Seven Principles for Good Practice in Undergraduate Education" (e.g. active learning, respect for diversity, cooperation, prompt feedback, and high expectations; Kuh, 2001b). In addition to institutions that promote these principles, it is important for students to perceive their college as inclusive and affirming. They must also feel that clear and rational goals are communicated (Bitzer & Troskie-De Bruin, 2004). Thus, the college environment should be welcoming, consistent, and predictable. Based on these
principles of active engagement and student perceptions, Kuh developed the National Survey of Student Engagement (Kuh, 2001b) to assess student engagement practices related to the academic climate of the institution and measure aspects such as challenge, collaboration, and support. Overall, although a focus of the Student Engagement Model is based primarily on what the student “does”, the importance of institutions fostering quality academic engagement in their students is also highlighted.

Summary of academic success theories

As illustrated in the aforementioned theories, there are various reasons or factors that influence academic success. There are several themes woven throughout the different perspectives, which reinforce the significance of these various factors. These themes are motivation, skills, environment, locus of control, and social foundation.

Motivation. Motivation is the key or underlining principle throughout most theories of success. Self-determination theory views motivation as the key proponent of achievement (Ryan, Connell, & Plant, 1990; Jones, Llancer-Arrastia, & Newbill, 2009). However, as shown through the subtheories of Self Determination Theory (i.e., Cognitive Evaluation Theory and Organismic Integration Theory), the motivational factors can be viewed from two different perspectives (Deci & Ryan, 1985; Deci & Ryan, 2002; Deci, Vallerand, Pelletie, & Ryan, 1991). In the Cognitive Evaluation Theory, individuals are motivated to obtain competence, autonomy, and relatedness (Deci & Ryan, 2002; Deci, Vallerand, Pelletie, & Ryan, 1991). In the Organismic Integration Theory, motivational factors lie on the continuum of intrinsic intentions (pure interest or meeting internal desires) to extrinsic intentions (external desires and/or rewards; Deci & Ryan, 1985; Deci, Vallerand, Pelletie, & Ryan, 1991).

Similar to Self-Determination Theory, other theories highlight the importance of motivation as the driving force behind many of the principles related to success. For example, in the I-E-O model, motivation is part of the input or the “individual” component of the model (Zhao, 2003; Bitzer & Troskie-De Bruin, 2004). Thus, an individual's motivational level, coupled with other personal characteristics, interacts with the environment and produces an outcome (e.g. academic success or failure; Zhao, 2003; Bitzer & Troskie-De Bruin, 2004). Self-Regulation Theory discusses the importance of motivational factors/behaviors, such as self-monitoring and goal-setting (Young, 2005). As noted by the theory, in order to perform self-regulated behaviors, which in turn produce positive academic outcomes, the student has to have a
certain degree of motivation (Nota, Soresi, & Zimmerman, 2004; Pintrich & De Groot, 1990). Finally, Achievement Goal Theory focuses on the motivating factors behind why a student is pursuing a goal (Wentzel, 1993). For instance, when a student has a mastery goal, he or she is trying to satisfy his or her need for competence (Harackiewicz, Barron, Tauer et al., 2002).

As discussed above, motivation is viewed as the driving force behind a student's behavior and academic performance (Deci, Vallerand, Pellete, & Ryan, 1991). The reasons that create this motivational force vary, such as meeting innate needs, intrinsic factors, extrinsic factors, self-regulated desires, mastery goals, and performance goals (Bitzer & Troskie-De Bruin, 2004; Harackiewicz, Barron, Tauer et al., 2002; Ryan, Connell, & Plant, 1990). Motivation impacts subsequent factors, such as skill, engagement, and retention. Therefore, it is a necessary factor to investigate when studying academic success (Nota, Soresi, & Zimmerman, 2004; Pintrich & De Groot, 1990; Ryan, Connell, & Plant, 1990; Zhao, 2003).

Academic skills. Some of the theories highlight the importance of an individual's academic skills. The theory that places the greatest importance on skills is the Self-Regulation Theory (Zimmerman, 2008). In this theory, in order to be successful, the student has to engage in various self-regulated academic behaviors, such as metacognitive, cognitive, behavioral, and motivational focused strategies (Zimmerman, 1990). For example, a successful student employs self-regulated study skills, such as elaboration, organization, information seeking, goal-setting, etc. (Nota, Soresi, & Zimmerman, 2004; Pintrich & De Groot, 1990; Zimmerman & Martinez-Pons, 1988). Similarly, the Student Engagement Model focuses on a student's academic engagement, or behaviors related to academic skills (Kuh, 2001a; Kuh, 2001b). According to this model, the amount of time a student is studying and is interacting with his or her academic environment influences his or her academic success (Kuh, 2001a; Kuh, 2001b). The Student Engagement Model does not assert that innate characteristics or prior knowledge influences academic achievement (Kuh, 2001a; Kuh, 2001b). However, the model depicts all students as capable learners as long as they use appropriate academic skills (Kuh, 2001a; Kuh, 2001b). On the other hand, the I-E-O model views both the student's ability and academic skills as the input in the input-environment-outcome equation, where the student brings his or her academic skills into the college environment (Bitzer & Troskie-De Bruin, 2004; Swing, 2001; Zhao, 2003). As such, this model also notes that the skills the student brings to college are just as important as the skills he or she gains while being in the college environment (Swing, 2001). Overall, these
models and theories highlight that motivation alone does not produce success, but it is the execution of the appropriate behaviors or skills that help achieve desired outcomes (Bitzer & Troskie-De Bruin, 2004; Nota, Soresi, & Zimmerman, 2004; Pintrich & De Groot, 1990; Zimmerman & Martinez-Pons, 1988; Zhao, 2003).

**Environment.** The environment has been shown to be an essential factor in various theories of success. For instance, as discussed above, in the I-E-O model, the individual interacts with his or her environment, which produces an outcome of success or failure (Bitzer & Troskie-De Bruin, 2004; Swing, 2001; Zhao, 2003). According to the I-E-O model, the environment is the college experience and/or the institution (Bitzer & Troskie-De Bruin, 2004; Zhao, 2003). In order to facilitate individual success, the student must be placed in an environment that increases the individual's strengths and promotes achievement (Bitzer & Troskie-De Bruin, 2004; Swing, 2001; Zhao, 2003). As discussed in the Student Engagement Model, there is a strong emphasis placed on the environment or institution promoting academic engagement of its students (Kuh, 2001a; Kuh, 2001b). If the environment does not encourage learning, then the student will not be successful because he or she does not have the appropriate medium to achieve (Kuh, 2001a). Unlike the "input" factor of the I-E-O model, it does not matter what skills, innate abilities, or motivational factors the student possesses, but it is the influence of the academic environment on success (Kuh, 2001a).

The Student Integration Model is similar to the Student Engagement Model, but it focuses on the social environment as well as the academic (Tinto, 1993). In the Student Integration Model, the student must integrate his or herself into the college environment (Tinto, 1993). Similar to the Cognitive Evaluation Theory, the student needs to feel connected or have a sense of relatedness to the institution in order to be successful (Sheldon & Krieger, 2007). If a student does not successfully interact with his or her college environment, the student most likely will not graduate (Tinto, 1993). If the environment fosters integration, then the student will graduate successfully (Tinto, 1993).

As demonstrated above, the environment and how the student interacts with his or her environment are important factors related to academic success (Swing, 2001). As a result, environmental factors that influence the individual (e.g., instruction and social influences) impact the probability of success (Bitzer & Troskie-De Bruin, 2004; Kuh, 2001a; Tinto, 1993; Zhao, 2003). Therefore, the investigation of the environment on success is warranted.
**Locus of control.** Several theories and models highlight the dichotomy or continuum between external and internal factors that influence performance (Deci & Ryan, 2002; Deci, Vallerand, Pelletie, & Ryan, 1999; Kuh, 2001a; Ryan, Connell, & Plant, 1990; Tinto, 1993; Zimmerman, 2008). The theory that best depicts the influence of external and internal factors is the Organismic Integration Theory (Ryan & Deci, 2000b). As discussed earlier, a successful student usually behaves due to internal/intrinsic reasons or pure interest and satisfaction (Ryan, Connell, & Plant, 1990; Jones, Llancer-Arrastia, & Newbill, 2009). External or extrinsic reasons for behavior occur for external gains or consequences (e.g. social approval rewards, etc) and reduce the likelihood of achievement (Benware & Deci, 1984). Similarly, the Achievement Goal Theory also highlights the differences between external and internal locus of control (Harackiewicz, Barron, Tauer, & Elliot, 2002). In this theory, mastery goals occur out of internal interest and mastery (Harackiewicz et al., 2000). Behaviors that occur out of performance goals are due to external factors or motivators, such as appearing competent or skilled to others (Harackiewicz et al., 2000). Finally, Self-Regulation Theory focuses on an internal, self-mastery approach to learning (Zimmerman, 2008). The individual takes it upon themselves to achieve and be successful (Zimmerman, 2008). On the contrary, the Student Engagement Model and the Student Integration model place more of the responsibility on external factors, such as the environment or institution (Kuh, 2001a; Tinto, 1993).

**Social foundation.** Several of the theories are derived from a social or social-cognitive theory (Deci & Ryan, 2002; Deci, Vallerand, Pelletie, & Ryan, 1999; Kuh, 2001a; Ryan, Connell, & Plant, 1990; Tinto, 1993; Zimmerman, 2008). For example, a social-cognitive or social-contextual perspective is the basis of almost all of the aforementioned theories of success (i.e., Achievement Goal Theory, Self-Regulation Theory, and Self-Determination Theory; Deci & Ryan, 2002; Deci, Vallerand, Pelletie, & Ryan, 1991; Harackiewicz, Barron, Tauer, & Elliot, 2002; Zimmerman, 2008). In a social-cognitive view, individuals watch others perform, which influences their cognitions of their own behavior, their expected outcomes, and strategies of performance (Bandura, 1989). For example, Achievement Goal Theory focuses on the cognitive process of why a student performs and desires to interact with their environment (Harackiewicz, Barron, Tauer, & Elliot, 2002). Self-Regulation Theory also stems from social-cognitive theory where social, environmental, and self-influences generate thoughts, feelings, and behaviors (Zimmerman, 1986, 2000, 2008). In Self-Determination theory, motivation is largely influenced
by the social context (Deci & Ryan, 1985). In fact, certain social situations can be the catalyst for behaviors of motivation and personal development, such as situations that foster autonomy (Fortier, Vallerand, & Guay, 1995). Finally, as shown in the Student Integration Model, Tinto (1993) places a large emphasis on the student's interaction with their social environment. In fact, a lack of connection to one's social environment is deemed as “social suicide”, which results in college attrition (Tinto, 1993). As illustrated in the theories discussed above, it is important to recognize the underlying social-contextual influence on individual behavior and motivation (Badura, 1986; Deci, Vallerand, Pelletie, & Ryan, 199; Harackiewicz, Barron, Tauer, & Elliot, 2002; Zimmerman, 2008). Therefore, the social influence on academic behaviors and academic success should be investigated as well.

As one could see, many of the theories of academic success emphasize the influence of non-ability factors on success. Even though there is evidence that innate ability explains 25% of the variance in academic success (Sternberg, 2003), the theories that are most prevalent in the academic success literature help explain the other factors related to success. Many universities and colleges use measures that focus more on ability (in areas such as English or math) or attained knowledge (i.e., history or science) to predict academic success (Coyle & Pillow, 2008; Hoffman & Lowitzki, 2005). However, assessments that measure the non-ability factors, such as motivation and environment, also provide utility (Pritchard & Wilson, 2003; Robbins et al., 2004). The following section will discuss traditional and nontraditional assessments of academic success, which are generally used to predict the likelihood of future success or explain current achievement.

**Measures of Academic Success**

**Traditional measures of academic success**

During the admissions process, colleges utilize various tools for predicting a student's academic success. Many post-secondary institutions use standardized measures and high school achievement (e.g. GPA, class-rank) as predictors of future success (Hoffman & Lowitzki, 2005; Hutto, 2004). The Scholastic Assessment Test (SAT) and the American College Test (ACT) are common standardized tests and are given to millions of high school students each year (Coyle & Pillow, 2008). The SAT measures verbal comprehension, math skills, and recently added writing skills, while the ACT measures knowledge gained in four academic areas of English, math,
reading, and science (Coyle & Pillow, 2008). The College Board is the educational association that provides these assessments to millions of students and thousands of high schools and colleges each year through their various educational testing and academic programs (Kobrin, Patterson, Shaw, Mattern, & Barbuti, 2008). As one could see, the use of standardized predictors of success is a common and traditional practice throughout the United States.

Given the popularity and frequent use of these standardized measures, it is important to explore whether they are accurately predicting future academic performance. Major educational research bodies have investigated whether standardized admission tests and secondary education achievement (i.e., high school GPA) predict post-secondary education achievement (i.e., college GPA), namely among college freshman (Zwick & Sklar, 2005). These educational research bodies include institutional associations (e.g., College Board), university admissions offices, and the work of testing researchers (Zwick & Sklar, 2005). Unfortunately, the findings on whether traditional standardized measures and prior achievement predict academic success are contradictory.

**Traditional measures of academic success as strong predictors.** There is some evidence that universities with more selective SAT/ACT and high school GPA criteria have better achievement and less attrition of their first-year students (DeBerard, Spielman, & Julka, 2004). Research has shown that standardized tests, in general, account for 20% of the variance in the academic performance of college freshman at best (Linn, 1989; Varney, 2008). Specifically SAT has shown to have a significant positive correlation of 0.44 with GPA, and explains 19% of GPA variance (Marsh, Vandehey, & Diekhoff, 2008). ACT specifically has shown to have a significant positive correlation of 0.43 with GPA, and explains approximately 18% of GPA variance (Marsh et al., 2008). There is some indication that the SAT and ACT significantly correlate g (i.e., innate intelligence; Coyle & Pillow, 2008). This high association largely explains the ACT and SAT validity (Jensen, 1998). However, after controlling for g, both tests continue to predict college GPA. These results suggest that SAT and ACT scores are strongly related to intelligence as well as non-g factors (Coyle & Pillow, 2008).

Studies have shown up to 25% of the variance in college GPA is explained by the standardized test scores and high school GPA (ACT, 1997; Camara & Echternacht, 2000; Robbins et al., 2004; Wolfe & Johnson, 1995). This is at least an additional 5% of variance explained above standardized measures alone. However, there is some indication that high
school GPA may be predict of achievement better than other predictors and measure of success (Breland, Maxey, Gernand, Cumming, & Trapani, 2002; Cliffordson, 2008). For example, a large scale study performed by several educational institutions surveyed 957 four-year institutions and rated high school GPA as the most important factor in admissions (Breland et al., 2002). According to research by Zwick and Sklar (2005) college GPA is best predicted by high school GPA when compared to SAT. When comparing high school GPA and SAT as sole predictors of GPA, high school GPA produced a $R^2$ value of .205 while SAT produced a $R^2$ valued of .117 (Zwick & Sklar, 2005). Therefore, in addition to standardized measures displaying some evidence in support of their utility, prior academic achievement has shown to be an additional and potentially stronger predictor of future achievement.

**Traditional measures of academic success as weak predictors.** The importance of standardized tests as indicators of success cannot be ignored; however, some critics argue that there are significant flaws with the standardized measures. For example, the President of the University of California suggests that there is an overemphasis on SAT and standardized scores, which are the educational equivalence of a nuclear arms race because institutions are using these scores with pure intentions (Atkinson, 2001). Such opinionated language is due to the fact that some students do not perform as well as test scores predict, or vice versa (Geiser & Studley, 2002). In fact, the State University System of California, the largest state university system in the country, has changed its policy and moved away from traditional admissions methods to more personalized approach (Eunhee, Newton, Downey, Benton, 2010; Robbins et al., 2004). Thus, the system has changed its view on indicators of academic success and now the system utilizes other measures, such as subject placement tests and interviews (Robbins, et al, 2004).

Some research has illustrated flaws within standardized college admissions tests. For example, research found that the gap between standardized scores and achievement is even more significant and apparent for minorities (Hoffman & Lowitzki, 2005). This gap suggests that standardized tests do not explain the same amount of variance across all races/ethnicities. Some studies have found that student background and high school GPA were as strong of a predictor as SAT scores (Rothstein, 2004). Thus, these results suggest that SAT did not sustain any more incremental validity after accounting for student background and high school GPA. In fact, some argue that the SAT's predictive ability comes from a strong association with demographic characteristics (Rothstein, 2004). There is some support for SAT II, which is designed to assess
mastery of a college preparatory subject, is less influenced by economic factors and a better predictor of academic performance than SAT I (Geiser & Studley, 2002).

There are some findings that suggest that SAT, ACT, and high school performance make little contribution to the prediction of college GPA. For example, after examining SAT scores and high school class rank of undergraduate students entering the University of Pennsylvania, SAT made a relatively small contribution to the prediction of college GPA (Baron & Norman, 1992). In addition, there is some evidence of weak psychometric properties of the SAT. For instance, as noted by MacGowan (2005), the College Board reports that the reliability coefficient of the writing section is .58, which is well under minimum standards for acceptable test reliability.

**Nontraditional measures of academic success**

As discussed above, the traditional measures of academic success have significant utility; however, there are some limitations (Rothstein, 2004; Hoffman & Lowitzki, 2005; MacGowan, 2005). One possible and additional limitation is the lack of association between traditional measures with theory. As shown in the theories of academic success section, a majority of the theoretical perspectives support the influence of non-ability factors on academic success, including factors such as motivation, self-regulation, student integration, etc. (Astin, 1993; Deci & Ryan, 2000; Harackiewicz, Barron, Tauer, & Elliot, 2002; Kuh, 2001a Tinto, 1993; Zimmerman, 1989). Therefore, in order to accurately measure or predict academic success, non-ability factors need to be assessed. The table below (see Table 2.1) is a review of nontraditional measures of academic success, which emphasizes the relevance of non-ability factors' contribution to success. As one could see, many of the measures below assess constructs discussed in the theory section.
<table>
<thead>
<tr>
<th>Academic Success Instruments</th>
<th>Authors</th>
<th>Constructs Measured</th>
<th>Psychometric Properties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academic Motivation Profile</td>
<td>Carey &amp; Pearson, 1989</td>
<td>Attention, relevance, confidence, and satisfaction (internal and external)</td>
<td>Alpha = .94, interfactor correlations = .41 - .53, EFA = 4 factor structure</td>
</tr>
<tr>
<td>Achievement Motivation Profile</td>
<td>Mandel, Friedland, &amp; Marcus, 1996</td>
<td>Motivation for achievement, interpersonal strengths, inner-resources, work habits</td>
<td>Alpha coefficients = 0.58 to 0.84, test-retest reliabilities = 0.61-.89</td>
</tr>
<tr>
<td>Academic Motivation Scale</td>
<td>Vallerand, et al. 1992</td>
<td>Amotivation, intrinsic motivation subscales, extrinsic subscales</td>
<td>Subscale alpha levels = .62 to .86, test-retest reliability = .71 to .83, Criterion validity = intrinsic subscales did not significantly correlate with GPA, extrinsic and amotivation had moderate correlations with GPA</td>
</tr>
<tr>
<td>College Persistence Questionnaire</td>
<td>Davidson, Beck, &amp; Milligan, 2009</td>
<td>Academic Integration, Social Integration, Support Services Satisfaction, Degree Commitment, Institutional Commitment, and Personality and Adjustment</td>
<td>Only reports test-retest reliability for 2 factors ($r = .78, r = .68$), PCA = 6 factors</td>
</tr>
<tr>
<td>Academic Success Instruments</td>
<td>Authors</td>
<td>Constructs Measured</td>
<td>Psychometric Properties</td>
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<tr>
<td>College Student Satisfaction Questionnaire</td>
<td>Starr et al., 1971</td>
<td>Satisfaction with working conditions, compensation, quality of education, social life, and recognition</td>
<td>Subscale alpha levels = .78 to .84, interscale correlations = .35 to .70</td>
</tr>
<tr>
<td>Learning and Study Strategies Inventory</td>
<td>Weinstein &amp; Palmer, 2002</td>
<td>Information Processing, Selecting Main Ideas, Test Strategies, Attitude, Anxiety, Concentration, Time Management, Study Aids, Motivation, and Self-Testing</td>
<td>Internal consistency of the subscales =.73 to .87, inter-scale correlations = .06 to .79, inconsistent underlying 3-factor model</td>
</tr>
<tr>
<td>Motivated Strategies for Learning Questionnaire</td>
<td>Pintrich, et al. 1993</td>
<td>Motivation subscales and Learning Strategies subscales</td>
<td>subscales reliabilities range from .52 to .90. Correlation to final course grade range from -.27 to .31</td>
</tr>
<tr>
<td>National Survey of Student Engagement</td>
<td>NSSE, 2002</td>
<td>College Activities; Educational and Personal Growth; Opinions About School</td>
<td>Subscale alpha levels = .84 to .90; PCA = 10 factors</td>
</tr>
<tr>
<td>Patterns of Adaptive Achievement Learning Survey (PALS)</td>
<td>Midgey et al., 1997</td>
<td>Mastery Goal Orientation, Performance-Approach Goal Orientation, Performance-Avoid Goal Orientation</td>
<td>GFI = 0.96, AGFI = 0.94, Scale Alpha Levels = .74 - .89</td>
</tr>
<tr>
<td>Self-Regulated Learning Interview Scale</td>
<td>Zimmerman &amp; Martinez Pons,</td>
<td>14 self-regulated learning strategies</td>
<td>Discriminates between High and Low</td>
</tr>
</tbody>
</table>
Table 2.1 – continued

<table>
<thead>
<tr>
<th>Academic Success Instruments</th>
<th>Authors</th>
<th>Constructs Measured</th>
<th>Psychometric Properties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student Integration Survey</td>
<td>Dowaliby, Garrison, &amp; Dagel, 1993</td>
<td>College Integration</td>
<td>Rasch analysis = 1 factor, person separation reliability index = .87, item separation index = .96</td>
</tr>
<tr>
<td>Student Life Stress Inventory</td>
<td>Gadzella, 1991</td>
<td>Types of stressors (frustrations, conflicts, pressures, changes, and self-imposed) and Reaction to stressors (physiological, emotional, behavioral, and cognitive)</td>
<td>Cronbach alpha levels = 0.76 – 0.93. CFA for Types of stressors = 5 factors, CFA for Reactions = 4 factors</td>
</tr>
<tr>
<td>Student Opinion Survey</td>
<td>Mcmillan, Simonetta &amp; Singh (1994)</td>
<td>Attitude and Self-efficacy of subjects matters</td>
<td>Test-retest reliabilities of subscales = .69 - .88, Convergent validity of subscales = .30 - .64</td>
</tr>
<tr>
<td>Time Management Behavior Scale</td>
<td>Macan, 1994</td>
<td>Setting Goals and Priorities; Mechanic of Time Management; Preference for Organization</td>
<td>CFA = 3 factors; Test–retest reliabilities = .51 to .70.</td>
</tr>
</tbody>
</table>

There is an array of academic success assessments measuring a variety of different constructs. There are some assessments that focus on motivation, such as the Academic
Motivation Profile (Mandel, Friedland, & Marcus, 1996), Achievement Motivation Profile (Mandel, Friedland, & Marcus, 1996), Academic Motivation Scale (Vallerand, et al. 1992), and Motivated Strategies for Learning Questionnaire (Pintrich, et al. 1993). Other assessments focus on the environment, either social or academic, as well as the student integration into his or her environment, such as the College Persistence Questionnaire (Davidson, Beck, & Milligan, 2009), College Student Satisfaction Questionnaire (Starr et al., 1971), National Survey of Student Engagement (NSSE, 2002), and Student Integration Survey (Dowaliby, Garrison, & Dagel, 1993). Some assessments focus on academic skills or self-regulation, such as the Self-Regulated Learning Interview Scale (Zimmerman & Martinez Pons, 1986), Time Management Behavior Scale (Macan, 1994), and the Learning and Study Strategies Inventory (Weinstein & Palmer, 2002). There are surveys that measure attitude and locus of control, such as the Academic Motivation Profile (Carey & Pearson, 1989), Student Opinion Survey (Mcmillan, Simonetta & Singh (1994), and Student Life Stress Inventory (Gadzella, 1991). Finally, the Patterns of Adaptive Achievement Learning Survey (Midgey et al., 1998) measures goal orientations.

Although nontraditional assessments have their main focus areas (i.e., motivation, self-regulation, etc.), there is a degree of similarity and contrast. For example, the Setting Goals and Priorities subscale on the Time Management Behavior Scale (Macan, 1994) is similar to the Patterns of Adaptive Achievement Learning Survey (Midgey et al., 1998) in regards to its emphasis on goals. The Degree Commitment and Institutional Commitment subscales on the College Persistence Questionnaire (Davidson, Beck, & Milligan, 2009) are similar to some of the motivation assessments. The Interpersonal Strengths and the Inner-Resources subscales on the Achievement Motivation Profile (Mandel, Friedland, & Marcus, 1996) are related to the constructs measured by the Student Life Stress Inventory (Gadzella, 1991). Moreover, although some assessments are measuring the same construct, the construct appears to be operationalized differently. For example, the Academic Motivation Profile (Mandel, Friedland, & Marcus, 1996) measures the continuum of extrinsic to intrinsic motivation. However, the Motivation Strategies for Learning Questionnaire (Pintrich, et al. 1993) measures motivation as extrinsic and intrinsic goal orientations, and includes values and beliefs in its measurement of motivation.

In addition to the overlap and multiple definitions of constructs, the psychometric properties of the nontraditional measures are questionable. First, many of the instruments are outdated, therefore their norms may not be relevant to present day. In addition, the internal
consistency or reliability of some of the measures is below the widely accepted minimum standard of 0.70 (Nunnally & Bernstein, 1994). For example, the reliability of the Motivated Strategies for Learning Questionnaire (Pintrich et al., 1993) is questionable because it has subscales with coefficient alpha level less than 0.70 (Duncan & McKeachie, 2005). The Achievement Motivation Profile (Mandel, Friedland, & Marcus, 1996) has shown to have a test-retest reliability as low as 0.61. According to Nunnally and Bernstein (1994) a reliability coefficient of 0.70 is sufficient for early stages of research. However, Nunnally and Berstein suggest that research should require a reliability coefficient of at least 0.80 and, when making important decisions, a reliability coefficient of at least 0.90. Unfortunately, many of the nontraditional academic success measures have weak reliability.

Some assessments did not have strong evidence of validity. For example, the Academic Motivation Scale (Vallerand, et al. 1992) intrinsic subscales had a non-significant association with GPA (Fairchild, Horst, Finney, & Barron, 2005); however, the extrinsic motivation and amotivation subscales were more strongly related to GPA (Cokley, Bernard, Cunningham, & Motoike, 2001). The validity of the Learning and Study Strategies Inventory (Weinstein & Palmer, 2002) as well as its factor structure are questionable due to inconsistencies shown from factor analyses (Prevatt et al., 2006). In addition, many of the measures focus on only one or a small portion of constructs in the academic success theories. There appears to be no measure that is comprehensive and assesses a large portion of constructs supported by theories of academic success. Therefore, there is a need for a more comprehensive measure of factors related to success.

**Summary of traditional and nontraditional measures**

There are varying differences between traditional and nontraditional measures of academic success. Traditional measures focus mainly on already attained knowledge (Coyle & Pillow, 2008). For instance, the SAT assesses math, verbal, and writing skills already gained. The ACT assesses prior math, English, science, and history knowledge (Coyle & Pillow, 2008). High school GPA is a direct measure of overall knowledge gained throughout high school (Breland, Maxey, Gernand, Cumming, & Trapani, 2002). However, all these traditional measures, at best, explain up to 25% of the variance in academic performance (ACT, 1997; Camara & Echternacht, 2000; Robbins et al., 2004; Wolfe & Johnson, 1995). Even though this
portion of explained variance is significant, it also highlights that additional factors influence academic success.

The nontraditional measures explain other factors that are associated with academic success besides already attained knowledge or ability (e.g. academic skills, environment, social influence, motivation, etc). The Learning and Study Strategies Inventory (Weinstein & Palmer, 2002) assesses academic skills/ self-regulation, the Academic Motivation Scale (Vallerand, et al. 1992) assesses student motivation, and the Patterns of Adaptive Achievement Learning Survey (Midgey et al., 1998) assesses achievement goal orientation, which are constructs highlighted in the academic success theories. Even though some of the measures have strong psychometric properties, some are significantly outdated and are not psychometrically sound.

Even though the use of nontraditional assessments is valuable, there is a lack of sound instrumentation. As a result, there is a need for instruments that accurately and reliably measure the factors discussed in the theories section. In addition, it would be beneficial to have a comprehensive measure that covers all or close to all aspects of academic success addressed by the different theories and models. Moreover, sound comprehensive measures of academic success would complement the existing traditional assessments of success (e.g. SAT, ACT, and high school GPA) and increase their predictive power and utility.

The Academic Success Inventory for College Students

The Academic Success Inventory for College Students (ASICS; Prevatt et al., 2011) is a self-report measure that assesses college academic success. The ASICS is a comprehensive assessment that represents several theories of academic success. As a result, the inventory incorporates many of the important factors related to a student's success in college (Prevatt, et al., 2011).

The ASICS is a 50-item measure with the following subscales: general academic skills, career decidedness, internal motivation/confidence, lack of anxiety, external motivation/future, concentration, socializing, personal adjustment, efficacy of the instructor, and external motivation/current (Prevatt et al., 2011). The ASICS is a measure that has promising utility as a tool for remediation and enhancement of academic performance (Prevatt et al., 2011).

The ASICS is a newly developed measure that has sound psychometric properties (Prevatt et al., 2011; Welles, 2010). The factor structure of the inventory was determined by exploratory and confirmatory factor analysis (Prevatt, et al., 2011). The internal structure of the
Inventory is strong and has subscale Cronbach alphas ranging from .93 to .77 (the extrinsic motivation/current time subscale has an internal consistency of .62; Prevatt, et al., 2011)). There is strong support for criterion and construct validity as evidenced by comparisons of honors students to students who are on academic probation (Prevatt, et al., 2011). Concurrent validity is evidenced by large, significant correlations between the subscales and GPA (Prevatt, et al., 2011). However, the ASICS may benefit from additional validation to improve the scale. Because preliminary investigations on the scale's validity and reliability have been conducted, an item analysis would be an appropriate next step in the validation process. The present study will conduct the next step in the validation of the ASICS. Below is a review of test construction and validation principles to support the purpose of the study. A degree of attention will be given to the importance of item analysis, specifically an Item Response Theory analysis.

**Test Construction and Validation Principles**

Science is based on the ability to detect and observe phenomena in nature and life, even if those phenomena are not directly observable (Fishman & Galguera, 2003). Tests are measurement devices used to quantify phenomena for prediction and understanding (Kaplan & Saccuzzo, 2009). Specifically, scales and inventories are generally used to measure attitudes, interests, and dispositions (AERA, APA, & NCME, 1999). Sound tests and instruments are the result of good test making and adherence to test construction principles (Kaplan & Saccuzzo, 2009).

Test development is a process of creating a measure that assesses a particular attitude, interest, skill, knowledge, and/or ability (AERA, APA, & NCME, 1999). “Validation can be viewed as developing a scientifically sound validity argument to support the intended interpretation of test scores and their relevance to the purposed use” (AERA, APA, & NCME, 1999, p. 9). As new evidence is accumulated about a test scores meaning, revisions to the test, the conceptual framework, and the construct underlying the test may be needed (AERA, APA, & NCME, 1999).

The decision regarding what types of evidence are needed for test validation is important (AERA, APA, & NCME, 1999). Since the goal of test construction is to prove a test's validity, it is important to determine whether or not it is measuring what it is intended to measure (AERA, APA, & NCME, 1999). However, validity is not the only goal of test development. Researchers
also need to know about the test's reliability (Fishman & Galguera, 2003). Reliability allows the test developers to have confidence in whether or not the test consistently measures the construct and phenomena of interest (Goodwin, 2010). The establishment of a test's reliability and consistency is imperative, especially before making interpretations about test results (Fink & Litwin, 1995). Finally, item analysis helps determine whether or not the test items are able to discriminate properly (Fishman & Galguera, 2003). For example, an item analysis informs researchers about individuals' likelihood to endorse certain items based on their possession of a latent trait (Embretson & Reise, 2000). For example, students with high achievement would be more likely to endorse particular items on the ASICS. Given the importance of investigating a scale's validity, reliability, and items, below will be a review of these principles.

**Reliability**

According to Goodwin (2010), reliability is the extent to which an assessment measures the same phenomena consistently and repeatedly. When developing a survey, it is imperative to test for reliability (Fink & Litwin, 1995). Assessments that have high reliability are less likely to have measurement error (Goodwin, 2010). Test score reliability indicates the degree to which test scores are consistent over many performances (Meyer, 2010).

There are four basic ways to evaluate a measurement's reliability: internal consistency, test-retest, alternative-form, and split-half analysis (Fink & Litwin, 1995). Each of these methods tests whether or not the assessment is producing similar results over time (Fink & Litwin, 1995). There is a strong relationship between reliability and validity (Fink & Litwin, 1995). Thus, providing evidence of a test's reliability will provide information on the test's validity (Messick, 1989). Once reliability is established, it is important to assess whether the assessment is measuring the construct it is intended to measure (Fink & Litwin, 1995). If a test is not reliable, then it is likely not valid (Fink & Litwin, 1995).

**Validity**

According to the American Educational Research Association (1999), validity is the most fundamental element of test development. Validity is an indication of the accuracy in which research conclusions correspond with reality (McBurney & White, 2010). Moreover, validity refers to “the degree to which evidence and theory supports the interpretations of test scores entailed by proposed uses of tests” (AERA, APA, & NCME, 1999, p. 9). Messick (1989) proclaims that it is not the test, but the inferences about the test's scores and the implications of
those inferences that should be evaluated. Once validity has been established and it is clear that the survey measures the constructs it is supposed to assess, only then can accurate conclusions be derived from the test (Fink & Litwin, 1995).

There are also four different forms of internal validity: face, content, criterion, and construct (Jackson, 2010). *Face validity* refers “to the extent to which a measuring instrument appears valid on the surface” (Jackson, 2010, p. 86). Face validity is determined by a cursory review of the items by untrained judges (Fink & Litwin, 1995). *Content validity* is “the extent to which a measuring instrument covers a representative sample of the domain of behaviors to be measured” (Jackson, 2010, p. 85). The validity of test content is determined and evaluated by experts in the field (Fink & Litwin, 1995). *Criterion validity* is the extent to which an instrument accurately predicts behaviors or abilities in a particular area (Jackson, 2010, p. 86). It is called criterion validity because the test results are compared to an outcome or criteria (e.g. grades, SAT scores, college retention rates; Goodwin, 2010). Some experts believe that *construct validity* is the most valuable form of validity, but may also be the most difficult type of validity to assess (Fink & Litwin, 1995). According to Messick (1989), neither face, content, and criterion validity alone is sufficient for testing purposes. The legitimacy of a measure ultimately rests on construct related evidence (Messick, 1989).

According to Messick (1989), construct validity is the most important factor because it informs the developers of the test scores meaning. Construct validity is “the degree to which a measuring instrument accurately measures a theoretical construct or trait that is designed to measure” (Jackson, 2010, p. 86). For instance, an instrument intended to measure the construct of academic success must be able to accurately represent that construct (i.e. academic success; DeVon, Block, Moyle-Wright, Ernst, Hayden, et al., 2007). Thus, construct validity is concerned with how well the underlying idea is reflected in the instrument (Messick, 1989). Moreover, construct validity differs from the other forms validity in that content validity supports claims about an individual's present performance level in multiple tasks or situations (Messick, 1989). Criterion validity supports claims about a person's present or future outcome on some related variable different than the actual assessment (e.g. GPA, SAT scores) whereas construct validity supports claims about the extent to which an individual possesses some trait or quality (Messick, 1989).
The investigation of construct validity can be similar to hypothesis testing and usually requires a great deal of effort (Fink & Litwin, 1995). When developing a new measure, it is very important that validity is evaluated and documented (Litwin & Fink, 1995). Approaches to construct validation usually include correlational and factor analysis procedures, but these approaches can be limited and have a degree of circularity (Wainer & Braun, 1988). However, the validity and reliability of a measure can be refined by an item analysis, which provides additional evidence about the construct being assessed (Fishman & Galguera, 2003).

**Item analysis**

Once an instrument has been piloted, it is important to evaluate the function of the individual items through item analysis (Aiken, 2000). According to Kaplan and Saccuzzo (2009), a good test has good items. Thus, item analysis may be considered one of the most important aspects of test construction and validation (Kaplan & Saccuzzo, 2009). Item analysis addresses the issues of test validity as well as reliability (Fishman & Galguera, 2003).

Item analysis is a general term for a set of methods used to evaluate the items of a test (Kaplan & Saccuzzo, 2009). A major aim of item analysis is to revise or remove items that are ineffective (Aiken, 2000). Instead of adding more items to a test to make it more reliable, item analysis allows the developer to choose items that are more efficient, reliable, and valid (Kaplan & Saccuzzo, 2009).

There are three ways to analyze test items: item difficulty, item discriminability, and item consistency (Fishman & Galguera, 2003). Each of these item evaluation methods has their own unique contribution to test validation, but these methods are interconnected as well (Fishman & Galguera, 2003). For tests of achievement or ability, *item difficulty* is “defined by the number of people who answer an item correctly” (Kaplan & Saccuzzo, 2009, p. 171). For tests where there is not a clear right or wrong answer, such as the ASICS or assessments with scaled responses, item difficulty is referred to as the likelihood an item is endorsed (Embretson & Reise, 2000). In this case, the researchers should look at how much each item response option contributes to the total score (Fishman & Galguera, 2003). *Item discriminability* refers to whether individuals who do well on particular items do well on the whole test (Kaplan & Saccuzzo, 2009). For tests without a clear right or wrong answer (e.g. Likert scale assessments), it is the extent to which answers to specific questions are consistent across the test (Kaplan & Saccuzzo, 2009). Finally, *item consistency* refers to each item's contribution to the test's
reliability (Kaplan & Saccuzzo, 2009). Item Response Theory is a sophisticated approach to item evaluation which analyzes item difficulty and discriminability (Embretson & Reise, 2000). This type of item analysis will be the focus of the present study and will be discussed below.

**Item Response Theory**

Item Response Theory (IRT) has been routinely applied to educational and psychological settings to measure abilities, traits, and proficiencies (Chang & Reeves, 2005). This approach was originally developed for standardized and aptitude tests with dichotomous items that require a certain response (e.g. yes or no; Harvey & Hammer, 1999). “IRT is a statistical theory using mathematical models to express the probability of an item response as a function of a latent trait of the test taker and item characteristics” (Chang & Reeve, 1995, p. 266). IRT is a newer approach to test development that contrasts traditional testing theory and many of the classical assumptions used today (Embretson & Reise, 2000). In order to understand the unique assumptions of IRT, it is important to review Classical Test Theory and the basic premises that underlie most test construction principles.

Classical Test Theory (CTT) has been the basis of instrument construction and has impacted the development of psychometrically sound instruments for over 80 years (Kline, 2005). The traditional approach to testing is to calculate a raw score or to compute a sum of scores (Busch, Hagemann, & Bender, 2010). However, this is only appropriate when the measure is unidimensional and the items are homogeneous (Busch, Hagemann, & Bender, 2010; Fischer & Molenaar, 1995; Zhu, 2006). According to Classical Test Theory, a raw score ($X$) is composed of both a true component ($T$) and a random error ($E$) component (Embretson & Reise, 2000):

$$X = T + E.$$  

Therefore, the average of one's raw scores ($X$) would be the best *estimate* of his/her true score ($T$) and the error ($E$), also known as the standard error of the measurement (Embretson & Reise, 2000; Scherbaum, Finlinson, Barden, & Tamanini, 2006). In CTT, the standard error of measurement is consistent across an entire population (Embretson & Reise, 2000; Scherbaum, Finlinson, Barden, & Tamanini, 2006). That is, the standard error is generated by large numbers of test administrations to various individuals (Kline, 2005). As a result, individuals with different traits have the same standard error (Embretson & Reise, 2000). Moreover, the standard error is the same regardless of the score (e.g. high, medium, or low; Kline, 2005). According to CTT, the
relationship between raw scores and true trait scores is linear and the confidence interval is consistent regardless of the score (Embretson & Reise, 2000). Thus, no matter the score (high, medium, or low), the relationship between the trait being measured and the raw score (which is the true trait plus the error) is the same (Embretson & Reise, 2000).

IRT, which is considered the new test theory, illustrates the relationship between traits being measured by an instrument and item responses (Froelich, 2009). IRT assumes one's answer to an item depends on both item and examinee's traits/characteristics (Froelich, 2009). As a result, some of the well-known CTT assumptions do not apply in IRT (Embretson & Reise, 2000).

According to Embretson and Reise (2000), in IRT, the standard error of a measure is variable and is not consistent across scores. Therefore, the relationship between a true trait score and a raw score is nonlinear (Embretson & Reise, 2000). In addition, the confidence interval is not fixed, but its width depends on the test score (Embretson & Reise, 2000). Most importantly, IRT does not depend upon population distributions, but controls for characteristics of the items, which influences the error (Embretson & Reise, 2000). Standard error is the smallest when items are most appropriate for a particular trait and item discrimination is high (Embretson & Reise, 2000).

In IRT, item responses can be dichotomous as well as polytomous (i.e. multiple choices for a response; DeMars, 2010). “The mathematical description for the item response is called an ‘item response function (IRF)’, an ‘item characteristic curve (ICC)’, or a ‘trace line’ (Chang & Reeves, 2005, p. 266). Since IRT assumes a nonlinear relationship between a trait and a response, the IRF or ICC usually provides either an s-shaped or curved depiction of the relationship of the trait level and the item response probability (Chang & Reeves, 2005). As trait level increases across the x-axis, the probability of the individual endorsing the item should increase along the y-axis (depending on the design of the item; Chang & Reeves, 2005). An example of an ICC is provided in Figure 2.1. As the trait of mental health decreases, the likelihood of the respondent endorsing the item (i.e., “As a result of any emotional problems, have you accomplished less than you would like?”) increases. The form of the item characteristic function curves illustrate how change in the trait relates to the probability of endorsing a certain response (Embretson & Reise, 2000). The slope also illustrates the discrimination level of the
item (Aiken, 2003). Therefore, the ICC provides test-makers with more detailed information on the function of individual items and guides the revision of test items (Embretson & Reise, 2000).

![Figure 2.1. Item Characteristic Curve. Retrieved from Chang, C. & Reeves, B. (2005). Item Response Theory and its applications to patient-reported outcomes measurement. Evaluation and the Health Professions, 28, 264-282.

An Item Category Curve is useful for polytomous data or items that have more than two response options (e.g. Likert scales; Embretson & Reise, 2000). In an Item Category Curve, the probability of endorsing each response option of an item is depicted in relation to one another (Embretson & Reise, 2000). Each response option curve is called a category response curve (Embretson & Reise, 2000). Figure 2.2 is an example of an Item Category Curve. As the trait level increases so does the likelihood of the item being endorsed. Individuals who possess low levels of the trait (e.g. -2) have an 80% probability of responding with a 0. Individuals who possess high levels of the trait (e.g. 2) have a 70% probability of responding with a 2. Overall, these category response curves are used to represent the most likely response for examinees along the trait continuum (Embretson & Reise, 2000).
Overall, there are several advantages to using Item Response Theory (Embretson & Reise, 2000). First, IRT provides evidence of construct validity by measuring the trait or construct measured by an assessment via item analysis (Busch, Hagemann, & Bender, 2010). Since the standard error of a test has an inverse relationship with reliability, IRT also provides support for test reliability in that the higher levels of discrimination denote better measurement precision (Harvey & Hammer, 1999). Moreover, according to Rivers, Meade, and Fuller (2009), there are practical benefits to using IRT. This procedure requires no additional data collection beyond the regular survey administration (Rivers, Meade, & Fuller, 2009). Therefore, test-makers could investigate the quality of their assessment with previously acquired data (Rivers, Meade, & Fuller, 2009). In addition, by assessing the relationship between the latent construct and item properties, IRT effectively controls for differences in the latent construct (Rivers, Meade, & Fuller, 2009). As a result, no random assignment or random sampling is required (Rivers, Meade, & Fuller, 2009).

Given its numerous advantages and the unique information it provides, Item Response Theory is an appropriate next step in the development and validation of the Academic Success Inventory for College Students. IRT would provide information on the function of individual test
items, the inventory's ability to measure the latent trait of academic success, and increase the understanding of academic success of college students.

Conclusion

Academic success during college and the completion of a college degree have been linked with several life benefits, such as higher employment rates, high income, better health, and more life opportunities (Institute of Higher Education Policy, 1998; Link & Phelan, 1995; Pascarella & Terenzini, 2005). Unfortunately, approximately 50% of incoming freshman drop out of college and do not receive a college degree (Brawer, 1996). Even though most colleges require a traditional entrance exam in order to predict future academic success (e.g., SAT, ACT), college students are performing at an array of different levels (U.S. Department of Education, 2004). Therefore, this brings to question what factors contribute to academic success and retention in college beside ability and attained knowledge. There are various theories that help explain academic success. These perspectives highlight the influence of non-ability factors (e.g., motivation, goal-orientation, self-regulation, environment, social integration, and academic engagement) on academic success (Bitzer & Troskie-De Bruin, 2004; Deci & Ryan, 2000; Harackiewicz, Barron, Tauer, & Elliot, 2002; Kuh, 2001; Tinto, 1993; Zimmerman, 2008). There are several measures of academic success that assess non-ability factors related to the theories of academic success, such as academic motivation, student integration, study-skills, goal-orientations, student persistence, self-regulation, etc. (Carey & Pearson, 1989; Davidson, et al, 2009; Dowaliby, et al, 1993; Gadzella, 1991; Macan, 1994; Mandel, et al, 1996; Midgey et al., 1998; Mcmillan et al., 1994; NSSE, 2002; Pintrich, et al. 1993; Starr et al., 1971; Vallerand, et al. 1992; Weinstein & Palmer, 2002; Zimmerman & Martinez-Pons, 1986). However, many of these instruments do not have sound psychometric properties. In addition, each instrument only measures a limited number of factors that contribute to academic success.

A comprehensive and psychometrically sound measure of academic success could provide great utility for students and institutions. Colleges and universities could use a measure that covers all the various aspects of success for predictive purposes and assist struggling students. For instance, students who are struggling academically could take a comprehensive measure of academic success and be provided with results that highlight area(s) of weakness (e.g., goals, motivation, self-regulated study habits, etc.). The institution could then provide the proper assistance for that student, thus increasing academic success and retention. Furthermore,
empirical research could benefit from a comprehensive measure in order to investigate the influence of the different factors on academic success. For instance, a comprehensive measure could be used to compare the strengths and weaknesses between different student groups. It also could eliminate the use of large assessment batteries into one psychometrically sound instrument. Therefore, further validation of a comprehensive measure such as the Academic Success Inventory for College Students would not only improve the Inventory, but also contribute to literature on academic success and help professionals assisting college students.

**Research Questions**

The current study was to evaluate the psychometric properties of an instrument that measures the academic success trait in college students using an Item Response Theory analysis. This study is meant to contribute to the research on the validity, reliability, and appropriateness of the Academic Success Inventory of College Students (Prevatt et al, 2011). Since there is limited research the on ASICS, information on the incremental utility of the scale would be beneficial for research and practical purposes. Moreover, this information would not only help validate and refine the inventory, but would also provide more detailed information about the different aspects of academic success and increase the understanding of factors that influence college achievement. Given the exploratory nature of the current study, the following research questions will be proposed:

1. What is the degree of the individual item fit for the employed IRT model?
2. What are the item and category difficulties and their spread?
3. What are the discriminating properties of each individual item?
CHAPTER THREE

METHODS

The literature review discussed the significance of collegiate academic success, theories related to academic success, problems with current academic success measures, and important principles of test construction. This chapter reviews the instrument of interest, the Academic Success Inventory for College Students (ASICS), and its development in more detail. The methods used to obtain participants and to analyze the ASICS through Item Response Theory is discussed below.

Instrumentation

The Academic Success Inventory for College Students (ASICS; Prevatt et al., 2011) is a self-report measure used to assess academic success in college students. The following review of the ASICS is based on Prevatt et al. (2011). The ASICS is a 50-item instrument with ten factors: general academic skills, career decidedness, internal motivation/confidence, external motivation-future, lack of anxiety, concentration, socializing, personal adjustment, efficacy of the instructor, and external motivation-current (Prevatt et al., 2011). Respondents answer each item according to the following prompt: “Select one class that has been the hardest or most difficult for you within the past year” (Prevatt et al., 2011). The ASICS can be used not only to identify at-risk college students, but also can identify growth areas for all college students. The development of the ASICS is discussed below.

According to Prevatt et al. (2011), the initial set of items for the ASICS was developed utilizing three distinct sources: a literature review, questionnaires used to survey ten college administrators and professors, and a sample of 315 undergraduate students who answered open-ended questions about their academic success. A pool of 72 Likert scale items was created and the content of the items were evaluated by a group of college academic success experts. After careful review, the ASICS was reduced to 62 items. In addition, the prompt for the items was also developed during this time. Since research has shown that college students respond differently when asked about specific areas of functioning, the researchers were interested in student performance in challenging courses. Therefore, the items were preceded with the following prompt: “Select one class that has been the hardest or most difficult for you within the
past year.” The items were designed on a seven point Likert scale from Strongly Disagree (1) to Strongly Agree (7) and anchors were provided for all points. The ASICS also contains negatively worded items that were reversed scored.

The ASICS was further analyzed by assessing the factor structure underlining the instrument (Prevatt et al., 2011). A sample of 930 students from a large public university in the southeastern region of the United States was administered the ASICS (Prevatt et al., 2011). Students with a range of grade point averages, such as students from the University Honors College and students at risk of academic dismissal, were included in the sample. An Exploratory Factor Analysis was conducted and a ten factor extraction was determined based on DiPerna (2004). An orthogonal rotation (varimax) was the most appropriate extraction method and indicated that ten factors explained 64% of the variance. In addition, 50 items were retained that had loadings more than .3, were conceptually meaningful, had communalities more than .30, and had low cross loadings (<.35; Brown, 2006; Tabachnick & Fidell, 2007). The following are the ten factors determined by the factor analysis: Skills, Internal Motivation/Confidence, Instructor Efficacy, Concentration, External Motivation/Future, Socializing, Career Decidedness, Lack of Anxiety, Personal Adjustment, and Motivation/Current Time (Prevatt et al., 2011).

According to Prevatt et al. (2011) and Welles (2010), the internal structure of the ASICS was examined by evaluating the internal consistency of the ten subscale scores and the following alphas levels and confidence intervals were found: General Academic Skills, .93 (.92-.94); Internal Motivation/Confidence, .86 (.85-.87); Instructor Efficacy, .92 (.92-.93); Concentration, .87 (.86-.88); External Motivation/Future, .88 (.86-.89); Socializing, .84 (.83-.86); Career Decidedness, .87 (.86-.88); Lack of Anxiety, .77 (.74-.80); Personal Adjustment, .86 (.84-.88); and External Motivation/Current Time, .62 (.58-.65).

Evidence of criterion and construct validity was also examined by comparing ASICS results to student academic performance (Prevatt et al., 2011; Welles, 2010). University Honors Program students were compared to students on academic probation (Welles, 2010). A multivariate analysis of variance (MANOVA) was used to assess subscale mean differences between honors students and students on academic probation (Welles, 2010). Univariate tests yielded significant differences for nine out of the ten subscales where Honor students had more positive functioning (Welles, 2010). However, there was no significant difference between the two groups in regards to External Motivation/Current Time (Welles, 2010). A multiple
regression analysis was also used to evaluate whether the ten factors predicted GPA (Prevatt et al., 2011). All ten factors were simultaneously entered into the regression analysis and results indicated that the ten factor model predicted 41% of the variation in GPA; $F(10,913) = 65.07, p < .01$ (Prevatt et al., 2011). This variance explained is well over the variance explained by traditional measures of academic success (e.g. SAT, ACT; Prevatt et al., 2011). However, when examining individual subscales, Career Decidedness, Efficacy of the Instructor, and Lack of Anxiety were not significant in the full model. However, all ten factors were retained. The factors are described in detail below and is from Welles (2010):

- **General Academic Skills (12 items)** – “a combination of effort expended, study skills, and self-organizational strategies” (e.g. “I made good use of tools, such as planners, calendars, or organizers.”; Welles, 2010)
- **Internal Motivation/Confidence (8 items)** – “belief in one’s abilities to perform well academically, as well as satisfaction and challenge associated with performance” (e.g. “I enjoyed the challenge of learning just for learning’s sake”; Welles, 2010)
- **Instructor Efficacy (5 items)** – “belief that the instructor was able to hold the attention of the student, organize, and teach in a manner that facilitated student learning” (e.g. “The instructor really motivated me to do well”; Welles, 2010)
- **Concentration (4 items)** – “ability to concentrate and pay close mental attention” (e.g. “It was easy to keep my mind from wandering”; Welles, 2010)
- **External Motivation/Future (4 items)** – “an awareness of the future relevance or importance of the class, with an emphasis on future external job-related issues” (e.g. “I needed to do well in this class to get a good job later on”; Welles, 2010)
- **Socializing (4 items)** – “appropriate levels of socializing or drinking such that one’s academic performance is not hindered” (e.g. “Sometimes my drinking behavior interfered with my studying”; reversed scored; Welles, 2010)
- **Career Decidedness (4 items)** – “progress towards and certainty of one’s decision about a career goal” (e.g. “I am certain about what occupation I want after I graduate”; Welles, 2010)
Lack of Anxiety (3 items) – “lack of anxiety or nervousness with regard to studying or test taking” (e.g. “I was nervous for tests even when I was well prepared.”; reversed scored; Welles, 2010)

Personal Adjustment (3 items) – “lack of personal issues that detract from one’s ability to perform academically” (e.g. “I had some personal difficulties that affected my performance”; reversed scored; Welles, 2010)

External Motivation/Current Time (3 items) – “motivation to perform, with an emphasis on current external factors such as grades, parents, or approval of others” (e.g. “I needed good grades to keep up my GPA”; Welles, 2010).

Participants

Archival data was used for this study. Participants in this dataset were recruited as follows: after obtaining approval from the university's human subjects committee, instructors of university courses were contacted. Upon receiving consent from course instructors, a link to the ASICS online survey was provided to the students via email. Completion of the ASICS was voluntary for all students. The online link included access to both the ASICS and demographic information questionnaire. The archival data set included approximately 1676 college students from a large public southeastern university. The data set included demographic information, such as college and high school GPA; however, this information was not needed for the IRT analysis.

Data Analysis

Item Response Theory was used to investigate the research questions above. The ASICS already had established preliminary evidence of validity and reliability (Prevatt et al., 2011; Welles, 2010). According to Prevatt et al. (2011), the factor structure of the ASICS indicates ten factors related to academic success. The correlations among the factors are low, indicating ten separate factors measuring ten separate latent traits. There are also negative correlations among some of the factors which indicate an inverse relationship among these factors. The theoretical underpinnings of the ASICS also suggest that the inventory is measuring a variety of latent traits. As a result of empirical and theoretical evidence, a unidimensional IRT analysis conducted on the entire inventory is not appropriate. A multidimensional IRT analysis would be the best fit for the data because it takes into consideration all the factors of the inventory and does not assume
the data is unidimensional. However, since a multidimensional IRT analysis is a newer procedure, there is no software available that can conduct a ten factor multidimensional IRT analysis. Therefore, separate unidimensional IRT analyses were conducted on each subscale of the inventory and were used to answer the three research questions.

First, descriptive information was provided on the ASICS including frequency of response options. Each subscale has a separate table (n=10) describing the frequency of each item response option as well as the mean, maximum, minimum, and standard deviation of each item.

Next, a unidimensional IRT was used to investigate the psychometric properties of the subscale items. The individual item fit for the employed IRT model was assessed for each individual subscale. Statistical criteria was used to help identify the level of fit of each item in each subscale via an item fit testing index provided by the PARSSCALE software, which provided an approximate chi-square test. The chi-square item fit statistic is provided for all 50 items. In addition, all the items were depicted through an Item Category Curve, similar to the figure below, to depict the item's psychometric structure (see Appendix B).

![Empirical Item Category Curve](image)

Test item difficulty/endorsement was also examined as well as the items' spread/category thresholds. The Logistic Graded Response Model (LGRM), which is a suitable for analyzing polytomous Likert style item responses, was employed. This analysis was parameterized to provide overall item difficulty/endorsement and item step difficulties/category thresholds. With this parameterization, the model was estimated by PARSCALE software. Since the items are polytomous Likert scale, the overall difficulty and the step difficulties were interpreted as item endorsement (e.g. examinees more or less likely to endorse the item).

Finally, the discriminating properties of each item were evaluated. Item discrimination was investigated to evaluate whether each item can detect varying levels of the subscale trait. Each item's slope ($a$) parameter was analyzed ($i = 50$). Items with slope parameter values below 1.0 were considered less discriminatory (the slope is flatter) than those with the slope parameter higher than 1.0. This study employs this 1.0 criterion as a rule of thumb to investigate item discriminations to identify “less discriminating” items (Embretson & Reise, 2000). The Item Category Curves in Appendix B are graphical representations of the items and can illustrate items that discriminate well and items that do not discriminate among individuals with different levels of the subscale traits.
CHAPTER FOUR

RESULTS

This chapter presents the psychometric properties of the items on the Academic Success Inventory for College Students, which was evaluated using descriptive and item analysis procedures. Descriptive properties of the ASICS were investigated, including mean, standard deviation, minimum score, maximum score, and response option frequencies. The ASICS items were analyzed using Logistical Graded Response Model (which is a type of Item Response Theory analysis), and the findings are described according to the proposed research questions. Table 4.1 lists the ASICS items according to the subscale, which can be used as a reference for understanding both the descriptive statistics and IRT results.

Table 4.1

**Academic Success Inventory for College Students (ASICS) Items**

<table>
<thead>
<tr>
<th>General Academic Skills Subscale</th>
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</thead>
<tbody>
<tr>
<td>06. I studied the correct material when preparing for tests in this class</td>
</tr>
<tr>
<td>10. I worked hard to prove I could get a good grade.</td>
</tr>
<tr>
<td>14. I tried everything I could to do well in this class</td>
</tr>
<tr>
<td>16. I worked really hard in this class.</td>
</tr>
<tr>
<td>28. I kept on a good study schedule in this class</td>
</tr>
<tr>
<td>36. I worked hard in this class because I wanted to understand the material.</td>
</tr>
<tr>
<td>39. I studied a lot for this class</td>
</tr>
<tr>
<td>41. I think I used good study skills when working in this class.</td>
</tr>
<tr>
<td>55. I made good use of tools such as planners, calendars and organizers in this class</td>
</tr>
<tr>
<td>56. I used a goal setting as a strategy in this class.</td>
</tr>
<tr>
<td>57. I was good at setting specific homework goals.</td>
</tr>
<tr>
<td>58. I was well organized.</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Internal Motivation/Confidence Subscale</th>
</tr>
</thead>
<tbody>
<tr>
<td>08. I got satisfaction from learning new material in this class</td>
</tr>
<tr>
<td>11. I enjoyed the challenge of just learning for learning’s sake in this class</td>
</tr>
<tr>
<td>12. I felt confident I could understand even the most difficult material in this class</td>
</tr>
<tr>
<td>13. I was pretty sure I could make an A or B in this class</td>
</tr>
<tr>
<td>22. I knew that if I worked hard, I could do well in this class</td>
</tr>
<tr>
<td>24. I worried a lot about failing this class*</td>
</tr>
<tr>
<td>34. I was pretty sure I would get a good grade in this class</td>
</tr>
<tr>
<td>35. I felt pretty confident in my skills and abilities in this class</td>
</tr>
</tbody>
</table>
Table 4.1 - continued

*Perceived Instructor Efficacy Subscale*
26. I was disappointed with the quality of the teaching*
29. I did poorly because the instructor was not effective*
33. I would have done better if my instructor were better*
42. The instructor in this class really motivated me to do well*
44. Anything I learned, I learned on my own. The instructor in this class was not a good teacher*

*Concentration Subscale*
04. It was easy to keep my mind from wandering in this class
07. I had an easy time concentrating in this class
19. I had a hard time concentrating in this class*
25. I got easily distracted in this class*

*External Motivation/Future Subscale*
09. I needed to do well in this class to get a good job later on
23. This class will be very useful to me in my career
46. This class is important to my future success
51. I think in the future I will really use the material I learned in this class

*Socializing Subscale*
15. Sometimes I partied when I should have been studying *
20. My grades suffered because of my active social life*
45. I got behind in this class because I spent too much time partying or hanging out with my friends*
54. Sometimes my drinking behavior interfered with my studying*

*Career Decidedness Subscale*
59. I am certain about what occupation I want after I graduate
60. I know what I want to do after I graduate
61. I am having a hard time choosing a major*
62. I am certain that my major is a good fit for me

*Lack of Anxiety Subscale*
05. I was nervous for tests even when I was well prepared*
18. Studying for this class made me anxious*
37. I got anxious when taking tests in this class*

*Personal Adjustment Subscale*
02. Personal problems kept me from doing well in this class*
30. I would have done much better in this class if I didn’t have to deal with other problems in my life*
50. I had some personal difficulties that affected my performance in this class*
Table 4.1 - continued

External Motivation/Current Time Subscale
31. It was important to get a good grade in this class for external reasons (my parents, A scholarship, university regulations)
32. I worked hard in this class because I wanted others to think I was smart.
49. I needed good grades in this class to keep up my GPA.

* Item was reverse scored

Descriptive Statistics for the ASICS

The mean, standard deviation, minimum, and maximum score for each ASICS item is provided below in Tables 3 through 12. In addition, the frequency of the response options for each ASICS item is also displayed. Response options on the ASICS are based on a 7-point Likert scale with the following stems: 1= Strongly Disagree, 2=Moderately Disagree, 3=Slightly Disagree, 4=Neutral, 5=Slightly Agree, 6=Moderately Agree, and 7= Strongly Agree. Items with high mean scores indicate that, in general, students reported more positive functioning related to academic success. Items with low mean scores indicate that, in general, students reported maladaptive functioning related to academic success.

All the negatively worded items were reverse scored in order to provide a consistent interpretation of the score’s meaning (i.e. high scores represent positive academic functioning and low scores represent poor academic functioning; Welles, 2010). For instance, item 19 (“I had a hard time concentrating in this class”) is a negatively worded item that was reverse scored. Students who are high in academic success should initially respond with a lower score (e.g. 1 = Strongly Disagree, 2= Moderately Disagree, etc.). On the other hand, item 16 (“I worked really hard in this class”) is an item that is not reverse scored. Students who are high in academic success would provide a higher score (e.g. 7= Strongly Agree, 6=Moderately Agree). Item 19 was reverse scored to match the direction of the other items, such as item 16. Negatively worded items were reversed before calculating the item means and response option frequencies so that higher means on the inventory consistently represent positive functioning. It is important to take this into consideration when interpreting reverse scored items. Therefore, higher means do not necessarily indicate agreement or endorsement of the item statement, but indicates endorsement of positive functioning on the item.
As seen in the tables below, there was wide variation in mean scores. The ten items with the highest means (5.96 to 4.77) indicate that students: believed they studied the correct material when preparing for tests, were internally and externally motivated to get good grades in class, believed their social life was not affecting their performance, and had decided on a future career and major. Alternately, the ten items with the lowest means (2.90 to 3.49) indicate that students: were worried about doing well in the class, were anxious about test performance, were not working hard to appear smart to others, had difficulty concentrating in class, did not use goal-setting strategies, and did not believe that the instructor motivated them to do well in class.

Table 4.2

General Academic Skills Subscale Descriptive Statistics

<table>
<thead>
<tr>
<th>Statistical Properties</th>
<th>Frequency of Response Options</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
</tr>
<tr>
<td>Item 06</td>
<td>5.40</td>
</tr>
<tr>
<td>Item 10</td>
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Note. Response option frequencies for each item total 1676 responses
Table 4.3

*Internal Motivation/Confidence Subscale Descriptive Statistics*

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*Note.* Response option frequencies for each item total 1676 responses

*Item reverse scored

Table 4.4

*Perceived Instructor Efficacy Subscale Descriptive Statistics*

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<td>411</td>
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*Note.* Response option frequencies for each item total 1676 responses

*Item reverse scored*
Table 4.5

*Concentration Subscale Descriptive Statistics*

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*Note.* Response option frequencies for each item total 1676 responses

*Item reverse scored

Table 4.6

*External Motivation/Future Subscale Descriptive Statistics*

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*Note.* Response option frequencies for each item total 1676 responses
Table 4.7

**Socializing Subscale Descriptive Statistics**

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</tr>
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<td>Item 45*</td>
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*Note.* Response option frequencies for each item total 1676 responses

*Item reverse scored

Table 4.8

**Career Decidedness Subscale Descriptive Statistics**

<table>
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*Note.* Response option frequencies for each item total 1676 responses

*Item reverse scored
Table 4.9

*Lack of Anxiety Subscale Descriptive Statistics*

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*Note.* Response option frequencies for each item total 1676 responses

*Item reverse scored*

Table 4.10

*Personal Adjustment Subscale Descriptive Statistics*

<table>
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<td>236</td>
<td>192</td>
<td>233</td>
</tr>
<tr>
<td>Item 30*</td>
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<td>2.02</td>
<td>1</td>
<td>7</td>
<td>191</td>
<td>167</td>
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*Note.* Response option frequencies for each item totals 1676 responses

*Item reverse scored*

Table 4.11

*External Motivation/Current Subscale Descriptive Statistics*

<table>
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<th>Item</th>
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<tr>
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<td>206</td>
<td>368</td>
<td>859</td>
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*Note.* Response option frequencies for each item totals 1676 responses
Item Response Theory Results

The section below is a review of Item Responses Theory and the review is based on Embretson and Reise (2000). Item Response Theory (IRT) is an approach using mathematical procedures to test whether or not items on a survey are psychometrically sound items. Surveys or inventories are made up of items and a psychometrically sound inventory has psychometrically sound items. Items are the individual questions asked on a survey. It is important to evaluate the quality of a survey's items. Items are evaluated using a process called item analysis. There are many item analyses that can be performed; Item Response Theory (IRT) is a particular type of procedure that evaluates the quality of survey items (Embretson & Reise, 2000).

IRT is a broad category of test evaluation techniques and a new approach to test development (Embretson & Reise, 2000). IRT measures the relationship between the latent traits being measured by an instrument and item responses. More specifically, IRT evaluates how well an inventory, at the item level, is measuring the latent traits it is intended to measure. Latent traits are the qualities or characteristics a test taker possesses that are not directly observable (e.g., external motivation, internal motivation, personal adjustment, etc.) and can only be inferred by demonstrated responses (Embretson & Reise, 2000). An item response is the answer a test taker provides to an item (Embretson & Reise, 2000). IRT assumes an answer to an item depends upon both the traits of the item (e.g., the difficulty level of an item) and upon the individual's personal trait and/or abilities which are often latent (i.e., not observable; Froelich, 2009).

IRT mathematically demonstrates the probability or likelihood one would respond to an item using an item response analysis (Embretson & Reise, 2000). Individuals who have a high amount of a trait should respond to questions differently than those who are low in a trait. For example, students who are high in internal motivation have a greater probability of responding one way whereas individuals low in internal motivation will respond another way to an item measuring internal motivation. IRT uses an Item Category Curve (ICC) to illustrate the relationship between the trait being measured by the item (i.e., personal characteristic) and item responses. More specifically, for a given trait the ICC gives the probability that an individual will score high or low on an item. Furthermore, the ICC illustrates the likelihood an individual with a given amount of a trait will answer with each response option (e.g. strongly agree, agree, strongly disagree, etc.; Embretson & Reise, 2000).
The ASICS (Prevatt et al., 2011) has polytomous items, which means that there are more than two possible response options for each question. There are no correct responses on the ASICS because the items are measuring one’s characteristics/traits (Prevatt et al., 2011). The ASICS items are structured in such a way that they measure the degree to which a test taker possesses a trait by using a Likert scale (Prevatt et al., 2011). The Likert scale is a scale with different response options that progress from strongly disagreeing to strongly agreeing with an item (Embretson & Reise, 2000). Each point on the Likert scale is a response option and a test taker is only allowed to choose one option per item (Embretson & Reise, 2000). The ASICS uses a 7-point Likert scale, which means there are seven different response options represented in the ICC (Embretson & Reise, 2000; Prevatt et al., 2011). The ICC illustrates the likelihood individuals would answer with each of the seven response options for a given item (Embretson & Reise, 2000).

Figure 4.1. Example of an Item Category Curve with seven response options (item 34 on the ASICS). Note: Ability on this graph is synonymous with trait and the x-axis represents the trait scale.

Figure 4.1 is an example of an Item Category Curve for an item with seven response options (Embretson & Reise, 2000). The x-axis is the horizontal line on the bottom of the ICC and represents the personal characteristic/trait being measured (e.g., motivation, concentration, or intelligence). Even though the trait values can be infinite, the trait continuum is represented by a scale that ranges from -3 to 3 with 0 representing the middle point of the trait continuum (Embretson & Reise, 2000). Individuals who possess a very low amount of a trait should be closer to -3 and individuals who possess a very high amount of a trait should be closer to 3. For the present study, the trait being measured is determined by the subscale the item is within. For
instance, the item in Figure 4.1 is part of the internal motivation subscale and the x-axis represents the continuum of the internal motivation trait. Individuals who possess a high amount of internal motivation would be closer to 3 on the trait scale and individuals who possess a low amount of internal motivation would be closer to -3 on the trait scale (Embretson & Reise, 2000).

The y-axis is the vertical line on the ICC and represents the probability of answering with a certain response (Embretson & Reise, 2000). Each curve on the ICC represents a different response option (1= Strongly Disagree to 7=Strongly Agree) and is labeled with the number associated with that response option. These curves are called response curves and illustrate the likelihood individuals with a certain amount of a trait will answer with a specific response option. For instance, individuals who possess a low amount of internal motivation and fall near -2 on the trait scale have a > 99% probability of answering with a 1. Individuals who possess a moderate amount of internal motivation and fall near 0 on the trait scale have a < 1% probability of answering with a 1 or 2; have approximately a 5% probability of answering with a 3; have an 80% probability of answering with a 4; have a 10% probability of answering with a 5; and have a <1% probability of answering with a 6 or 7. Individuals who possess a high amount of internal motivation and fall around 2 on the trait scale have a > 99% probability of answering with a 7 and <1% probability of answering with a 6 or lower.

As stated previously, IRT is a broad category of statistical procedures and there are many IRT analyses that can be performed (Embretson & Reise, 2000). For instance, there are unidimensional analyses and multidimensional analyses. Unidimensional analyses investigate the relationship between a single trait and item responses. Multidimensional analyses investigate the relationship between multiple traits and item responses. Since multidimensional IRT analyses are fairly new, there is no software that can perform a multidimensional IRT analysis on a inventory with ten traits. As a result, the present study performs unidimensional analyses of each of the ten ASICS subscales. Thus, ten separate unidimensional IRT analyses were conducted (one analysis per subscale) to answer the study's research questions (Embretson & Reise, 2000).

Unidimensional IRT analyses are fairly common and there are multiple types of unidimensional analyses that can be performed (Embretson & Reise, 2000). It is important to choose an analysis that is best suited for the inventory it is evaluating and the type of data that is being used in the study. Unidimensional analyses can be performed on inventories with items that have only two response options or items that have multiple response options (e.g.
polytomous items or Likert scales; (Embretson & Reise, 2000). The current study used a Logistic Graded Response Model, which is a type of unidimensional analysis appropriate for questionnaires with a Likert scale format (Samejima, 1969).

There are some unique aspects of a Logistic Graded Response Model (Embretson & Reise, 2000). First, this type of analysis allows the shape of the response curves to vary and not be fixed. Since the shape of the response curves are variable, this provides more accurate information on how particular each response option is to individuals with a certain amount of a trait. In addition, Logistic Graded Response Model allows for each item to have a different set of category thresholds. Thresholds provide information about how much of a trait individuals tend to possess to answer with a certain response option (Embretson & Reise, 2000). The discussion on the results of research question two further explains the function of category thresholds and item endorsement. The discussion on the results of research question 3 further explains the significance of response curve shapes and item slopes.

In summary, the ASICS items were evaluated using Item Response Theory and the relationships between the ASICS traits and item responses were investigated. The specific IRT analysis that was employed was a Logistic Graded Response Model. The PARSCALE software, which is an IRT computer software, was used to perform this investigation. Separate unidimensional IRT analyses were conducted for each of the ASICS subscales. The findings below include item-fit statistics, slope index, overall item endorsement, and category thresholds. The ICCs for all 50 ASICS items are provided in Appendix B.

**Research question one**

The first research question was to explore each ASICS item's degree of fit to the expected model. The following is an explanation of IRT item fit according to Embretson and Reise (2000). The expected model represents the ideal or hypothesized Item Category Curve (ICC) for an item with sound psychometric properties given the item parameters (e.g. 7-point Likert scale, unidimensional). The empirical model is the actual ICC for a particular item (shown in Appendix B). An item fit analysis compares how well the empirical model matches the expected model for a given item. In order to judge item fit, a computer software program is needed to evaluate how well each empirical model matches the expected model. In addition, item fit not only provides information on how well the empirical model matches the expected model, but also gives some
insight into how well the IRT analysis used in the study explains or predicts item responses. (Embretson & Reise, 2000).

A chi-square fit statistic ($\chi^2$) and probability level are typically used to determine how well models match one another. According to Embretson and Reise (2000), when there is no significant difference between the expected model and the empirical model, the probability level is more than 0.05. This indicates that the actual item fits the expected or “ideal” model and has sound psychometric properties. When there is a significant difference between the expected model and the empirical model, the probability level would be less than 0.05. This suggests that the actual item may not have sound psychometric properties and the empirical model does not match the expected model. According to Embretson and Reise (2000), poor item fit also may be due to one or more of the following: the IRT analysis not accurately explaining item responses, unaccounted multidimensionality, and issues of nonmonotonicity (the trait level does not increase with item responses).

The PARSCALE software was used in the present study to calculate the expected model and the empirical model for each item. The chi-square fit statistic ($\chi^2$) and probability level were used to evaluate the fit of all 50 items to the expected model. According to the chi-square statistic and probability levels for each of the 50 items, none of the items fit into their expected models. The probability level of each item was below 0.05, which suggests a significant difference between the expected model and the empirical model for each item. Thus, the expected model and the empirical model do not match and there is a statistically significant difference between the models. This means that the expected models, which are created upon a Logistic Graded Response Model parameterization/calculations, do not represent the empirical models. This can mean one of the following: that the items do not measure their respective traits, the IRT analysis does not represent the data, or there are issues with the data. The discussion section will further evaluate these three possible interpretations. Tables 4.12 through 4.21 display each item's chi-square statistic, degree of freedom, and probability level.
### General Academic Skills Subscale Item-Fit Statistic

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<td>80.93574</td>
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<td>&lt;0.001</td>
</tr>
<tr>
<td>Item 41</td>
<td>61.47341</td>
<td>33</td>
<td>0.002</td>
</tr>
<tr>
<td>Item 55</td>
<td>113.69696</td>
<td>43</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Item 56</td>
<td>110.46056</td>
<td>38</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Item 57</td>
<td>86.78132</td>
<td>38</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Item 58</td>
<td>76.915800</td>
<td>38</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

### Internal Motivation Subscale Item-Fit Statistic

<table>
<thead>
<tr>
<th>Items</th>
<th>$\chi^2$</th>
<th>D.F.</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item 08</td>
<td>123.76266</td>
<td>52</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Item 11</td>
<td>238.20634</td>
<td>53</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Item 12</td>
<td>131.96504</td>
<td>49</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Item 13</td>
<td>131.70905</td>
<td>39</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Item 22</td>
<td>175.64877</td>
<td>47</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Item 24</td>
<td>226.15297</td>
<td>51</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Item 34</td>
<td>142.85289</td>
<td>18</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Item 35</td>
<td>101.02183</td>
<td>17</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>
Table 4.14

**Perceived Instructor Efficacy Subscale Item-Fit Statistic**

<table>
<thead>
<tr>
<th>Items</th>
<th>( \chi^2 )</th>
<th>D.F.</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item 26</td>
<td>150.97675</td>
<td>22</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Item 29</td>
<td>118.68188</td>
<td>21</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Item 33</td>
<td>132.03615</td>
<td>28</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Item 42</td>
<td>271.67825</td>
<td>39</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Item 44</td>
<td>108.11267</td>
<td>34</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Table 4.15

**Concentration Subscale Item-Fit Statistic**

<table>
<thead>
<tr>
<th>Items</th>
<th>( \chi^2 )</th>
<th>D.F.</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item 04</td>
<td>257.46429</td>
<td>36</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Item 07</td>
<td>231.75789</td>
<td>31</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Item 19</td>
<td>356.01877</td>
<td>33</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Item 25</td>
<td>269.03345</td>
<td>33</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Table 4.16

**External Motivation/Future Subscale Item-Fit Statistic**

<table>
<thead>
<tr>
<th>Items</th>
<th>( \chi^2 )</th>
<th>D.F.</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item 09</td>
<td>181.66847</td>
<td>38</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Item 23</td>
<td>131.26613</td>
<td>26</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Item 46</td>
<td>146.18326</td>
<td>29</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Item 51</td>
<td>147.22348</td>
<td>36</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>
Table 4.17

**Socializing Subscale Item-Fit Statistic**

<table>
<thead>
<tr>
<th>Items</th>
<th>$\chi^2$</th>
<th>D.F.</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item 15</td>
<td>303.66449</td>
<td>35</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Item 20</td>
<td>187.11816</td>
<td>28</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Item 45</td>
<td>243.50409</td>
<td>22</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Item 54</td>
<td>236.10670</td>
<td>45</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Table 4.18

**Career Decidedness Subscale Item-Fit Statistic**

<table>
<thead>
<tr>
<th>Items</th>
<th>$\chi^2$</th>
<th>D.F.</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item 59</td>
<td>458.13727</td>
<td>21</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Item 60</td>
<td>421.53333</td>
<td>20</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Item 61</td>
<td>366.0769</td>
<td>40</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Item 62</td>
<td>1634.72839</td>
<td>46</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Table 4.19

**Lack of Anxiety Subscale Item-Fit Statistic**

<table>
<thead>
<tr>
<th>Items</th>
<th>$\chi^2$</th>
<th>D.F.</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item 05</td>
<td>441.5723</td>
<td>46</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Item 18</td>
<td>530.0946</td>
<td>34</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Item 37</td>
<td>519.80231</td>
<td>41</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Table 4.20

**Personal Adjustment Subscale Item-Fit Statistic**

<table>
<thead>
<tr>
<th>Items</th>
<th>$\chi^2$</th>
<th>D.F.</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item 02</td>
<td>992.22150</td>
<td>44</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Item 30</td>
<td>328.72708</td>
<td>27</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Item 50</td>
<td>325.23212</td>
<td>28</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>
Table 4.21

*External Motivation/Current Subscale Item-Fit Statistic*

<table>
<thead>
<tr>
<th>Items</th>
<th>$\chi^2$</th>
<th>D.F.</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item 31</td>
<td>1096.20593</td>
<td>36</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Item 32</td>
<td>910.92365</td>
<td>34</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Item 49</td>
<td>393.52408</td>
<td>30</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

**Research question two**

The aim of the second research question was to investigate each item's overall difficulty and step/category difficulties. The following is a review of IRT item difficulty/endorsement and is based on Embretson and Reise (2000). Since polytomous inventories (e.g. measures with Likert scale items) do not necessarily have right or wrong answers, item difficulty is interpreted as the likelihood an item would be endorsed (i.e. endorsement level). For the present study, the endorsement level will be interpreted as the likelihood examinees endorse *positive functioning* on an item. As discussed above, the negatively worded items were reversed and higher mean scores represent a higher amount of positive academic functioning. In the present study, high scores do not represent agreement with item statements, but represent positive academic functioning. Examinees who are high in academic success would *not* agree with negatively worded items because those items are asking about unhealthy thoughts/behaviors. They would provide a lower response option, which has to be reversed scored to be in the same direction of the other items. Therefore, endorsement should be interpreted as endorsement of positive functioning (Embretson & Reise, 2000).

The location parameter ($\lambda_i$) is the score that is used to evaluate the endorsement/difficulty level of an item and represents the placement of the item on the latent trait continuum (Scherbaum, Finlinson, Barden, & Tamanini, 2006). As stated above, the trait scale is a progression of lower to higher levels of the latent trait where 0 represents the middle point of the latent trait continuum (Embretson & Reise, 2000; Scherbaum, Finlinson, Barden, & Tamanini, 2006). The location parameter is represented by a Lambda value ($\lambda$), which tends to fall between -3 (a low location parameter) and 3 (a high location parameter; (Embretson & Reise, 2000; Scherbaum, Finlinson, Barden, & Tamanini, 2006). Items with location parameters near 0 indicate that the item is placed on the middle of the trait scale and has appropriate endorsement.
Thus, individuals who possess a high amount of a trait tend to provide answers of positive functioning and individuals who possess a low amount of a trait tend to provide answers of poor functioning. As described by Embretson and Reise (2000), items with location parameters above 0.3 are high and items with location parameters below 0.3 are low. Ideally, an item should be placed at the 0 marker of the scale and have a location parameter at zero. This means the item is not easy or hard to endorse and falls at the middle of the trait continuum. For items that have high location parameters, few examinees are expected to score with a higher response option or endorse positive functioning. The overall placement of the item is higher on the trait scale (above 0 the middle marker). The response curves tend to fall higher on the trait scale, which means individuals need to possess a higher amount of general academic skills in order to endorse positive functioning on the item (Embretson & Reise, 2000).

For items that have low location parameters, many examinees are expected to score with a higher response option or endorse the item (Embretson & Reise, 2000). The overall placement of the item is lower on the trait scale (below 0 the middle marker). The response curves tend to fall lower on the trait scale, which means individuals need to possess a lower amount of a trait in order to endorse positive functioning on an item. Low location parameters are negative and generally fall below 0.3. Low location parameters mean that it is less difficult/ more likely that individuals would endorse positive functioning on the item. Figure 4.2 is an example of an item with a high location parameter (i.e. examinees are less likely to endorse positive functioning) and Figure 4.3 is an example of an item with a low location parameter (i.e. examinees are more likely to endorse positive functioning; Embretson & Reise, 2000).

Figure 4.2. Example of an item with a high location parameter ($\lambda = 0.50954$).
In addition to location parameters, category thresholds represent the category/step difficulty (Embretson & Reise, 2000). Category thresholds provide information on the likelihood individuals will answer with a certain response option based upon the amount of a trait they possess. More specifically, a threshold represents a point along the trait scale at which examinees have a 50% chance of answering with a given response option and 50% chance of answering with a higher response option (Embretson & Reise, 2000). Thresholds answer the question of how much of a trait does one need to possess in order to answer with a certain response. There is a threshold between each response option for an item and each threshold is represented with a β (Embretson & Reise, 2000). Since the present study uses a 7-point Likert scale, there are six category thresholds for each item and these thresholds fall between the seven response options (e.g. β₁, β₂, β₃, β₄, β₅, and β₆). Similar to location parameters, threshold values tend to fall between -3 and 3. Item 4 in Figure 5 will be used as an example and has the following category thresholds: β₁ = -0.80604, β₂ = -0.13111, β₃ = 0.41627, β₄ = 0.75835, β₅ = 1.08165, and β₆ = 1.73812.

The first threshold (β₁) falls between response option 1 (Strongly Disagree) and response option 2 (Moderately Disagree). β₁ indicates the point along the trait scale where individuals have a 50% chance of responding with a 1 and 50% chance of responding with a 2 or higher. For item 4 individuals who fall above -0.80604 on the trait scale have a greater chance of answering with 2 or higher and individuals who fall below -0.80604 on the trait scale have a greater chance of responding with a 1. The second threshold (β₂) falls between response option 2 and response option 3 (Disagree) and is further along the trait scale. β₂ indicates the point along the trait scale where individuals have a 50% chance of responding with a 2 and 50% chance of responding with a 3 or higher. For the current example, individuals who fall above -0.13111 on the trait scale
are more likely to respond with a 3 or higher and individuals who fall below -0.13111 on the trait scale are more likely to answer with a 2. This progression continues for thresholds $\beta_3$ to $\beta_6$. The $\beta_6$ threshold is the last point along the trait scale and falls between response option 6 (Moderately Agree) and response option 7 (Strongly Agree). $\beta_6$ indicates the point along the trait scale where individuals have a 50% chance of responding with a 7 or a 50% chance of responding with a 6. For item 4, individuals who fall above 1.73812 on the trait scale, have a greater chance of answering with a 7. Individuals who fall below 1.73812 have a greater chance of responding with a 6. Tables 4.22 through 4.31 displays each item's overall endorsement level and category thresholds parameters.

Table 4.22

<table>
<thead>
<tr>
<th>Item</th>
<th>$\Lambda$</th>
<th>$\beta_1$</th>
<th>$\beta_2$</th>
<th>$\beta_3$</th>
<th>$\beta_4$</th>
<th>$\beta_5$</th>
<th>$\beta_6$</th>
</tr>
</thead>
<tbody>
<tr>
<td>06</td>
<td>-1.86894</td>
<td>-4.56396</td>
<td>-3.4032</td>
<td>-2.48864</td>
<td>-1.52453</td>
<td>-0.48977</td>
<td>1.25645</td>
</tr>
<tr>
<td>10</td>
<td>-0.33800</td>
<td>-1.82897</td>
<td>-1.21161</td>
<td>-0.70716</td>
<td>-0.03024</td>
<td>0.53489</td>
<td>1.21509</td>
</tr>
<tr>
<td>14</td>
<td>-0.23401</td>
<td>-1.52359</td>
<td>-0.89356</td>
<td>-0.41238</td>
<td>-0.09211</td>
<td>0.3834</td>
<td>1.13417</td>
</tr>
<tr>
<td>16</td>
<td>-0.37947</td>
<td>-1.73544</td>
<td>-1.06142</td>
<td>-0.625</td>
<td>-0.20898</td>
<td>0.29002</td>
<td>1.06400</td>
</tr>
<tr>
<td>28</td>
<td>0.26750</td>
<td>-1.15669</td>
<td>-0.55925</td>
<td>-0.02042</td>
<td>0.48407</td>
<td>1.10057</td>
<td>1.75672</td>
</tr>
<tr>
<td>36</td>
<td>-0.27296</td>
<td>-1.85970</td>
<td>-1.25005</td>
<td>-0.66469</td>
<td>-0.0372</td>
<td>0.66107</td>
<td>1.51281</td>
</tr>
<tr>
<td>39</td>
<td>-0.31335</td>
<td>-1.70379</td>
<td>-1.04442</td>
<td>-0.55186</td>
<td>-0.14215</td>
<td>0.42393</td>
<td>1.13818</td>
</tr>
<tr>
<td>41</td>
<td>0.00099</td>
<td>-1.41637</td>
<td>-0.87292</td>
<td>-0.34121</td>
<td>0.17919</td>
<td>0.80486</td>
<td>1.65240</td>
</tr>
<tr>
<td>55</td>
<td>0.04140</td>
<td>-1.21989</td>
<td>-0.69980</td>
<td>-0.24304</td>
<td>0.24738</td>
<td>0.77673</td>
<td>1.38702</td>
</tr>
<tr>
<td>56</td>
<td>0.37918</td>
<td>-0.97915</td>
<td>-0.41014</td>
<td>-0.01364</td>
<td>0.62132</td>
<td>1.19786</td>
<td>1.85883</td>
</tr>
<tr>
<td>57</td>
<td>0.28155</td>
<td>-1.08042</td>
<td>-0.56495</td>
<td>-0.09587</td>
<td>0.52958</td>
<td>1.09165</td>
<td>1.80931</td>
</tr>
<tr>
<td>58</td>
<td>-0.08453</td>
<td>-1.41199</td>
<td>-0.86798</td>
<td>-0.42923</td>
<td>0.05244</td>
<td>0.70237</td>
<td>1.44721</td>
</tr>
</tbody>
</table>

Items 14, 28, 36, 41, 55, 57, and 58 had moderate location parameters. Item 56 has a high location parameter meaning that few examinees endorsed positive functioning on this item. This suggests that examinees were less likely to indicate they used goal-setting techniques in order to perform well in class. However, many of the items on the General Academic Skills subscale had low location parameters meaning that many examinees endorsed positive functioning on these items.
items (e.g. items 6, 10, 16, & 39). This suggests that examinees were more likely to indicate they tried to prove they could get a good grade, worked really hard, and studied a lot for their most difficult class. Item 6 had very high endorsement, indicating that most examinees believed they studied the correct material for their most difficult class. The category thresholds for the items are appropriate.

Table 4.23

Internal Motivation/Confidence Subscale Overall Item Endorsement Level & Category Thresholds

<table>
<thead>
<tr>
<th>Item</th>
<th>$\lambda$</th>
<th>$\beta_1$</th>
<th>$\beta_2$</th>
<th>$\beta_3$</th>
<th>$\beta_4$</th>
<th>$\beta_5$</th>
<th>$\beta_6$</th>
</tr>
</thead>
<tbody>
<tr>
<td>08</td>
<td>-0.11453</td>
<td>-2.39155</td>
<td>-1.44543</td>
<td>-0.80841</td>
<td>0.1664</td>
<td>1.23662</td>
<td>2.55519</td>
</tr>
<tr>
<td>11</td>
<td>0.50349</td>
<td>-1.51288</td>
<td>-0.73567</td>
<td>-0.15165</td>
<td>0.88975</td>
<td>1.76657</td>
<td>2.76483</td>
</tr>
<tr>
<td>12</td>
<td>0.16380</td>
<td>-1.51164</td>
<td>-0.72964</td>
<td>-0.14158</td>
<td>0.39714</td>
<td>1.05238</td>
<td>1.91614</td>
</tr>
<tr>
<td>13</td>
<td>-0.21288</td>
<td>-1.48085</td>
<td>-0.93341</td>
<td>-0.43407</td>
<td>-0.02734</td>
<td>0.48872</td>
<td>1.10967</td>
</tr>
<tr>
<td>22</td>
<td>-1.41498</td>
<td>-3.81748</td>
<td>-2.76609</td>
<td>-1.84894</td>
<td>-1.00805</td>
<td>-0.07286</td>
<td>1.02354</td>
</tr>
<tr>
<td>24</td>
<td>0.55578</td>
<td>-1.15511</td>
<td>-0.35076</td>
<td>0.41884</td>
<td>0.96144</td>
<td>1.40525</td>
<td>2.05502</td>
</tr>
<tr>
<td>34</td>
<td>-0.10924</td>
<td>-1.43765</td>
<td>-0.8903</td>
<td>-0.41022</td>
<td>0.13828</td>
<td>0.66746</td>
<td>1.27698</td>
</tr>
<tr>
<td>35</td>
<td>-0.08450</td>
<td>-1.41094</td>
<td>-0.84247</td>
<td>-0.40475</td>
<td>0.1561</td>
<td>0.68667</td>
<td>1.30839</td>
</tr>
</tbody>
</table>

Items 8, 13, 34, and 35 had moderate location parameters. Item 22 had a low location parameter which indicates that many examinees endorsed positive functioning in internal motivation on this item. This low location parameter suggests that examinees were more likely to believe if they worked hard they could do well in their most difficult class. Items 11 and 24 had high location parameters indicating that few examinees endorsed positive functioning in the area of internal motivation on these items. These scores suggest that examinees were less likely to indicate they enjoyed the challenge of learning or they did not worry about doing well in the class. The category thresholds for the items on the Internal Motivation subscale are appropriate.
Table 4.24

Perceived Instructor Efficacy Subscale Overall Item Endorsement Level & Category Thresholds

<table>
<thead>
<tr>
<th>Item</th>
<th>λ</th>
<th>β₁</th>
<th>β₂</th>
<th>β₃</th>
<th>β₄</th>
<th>β₅</th>
<th>β₆</th>
</tr>
</thead>
<tbody>
<tr>
<td>26</td>
<td>-0.09262</td>
<td>-1.05007</td>
<td>-0.70575</td>
<td>-0.264</td>
<td>0.17102</td>
<td>0.42221</td>
<td>0.87087</td>
</tr>
<tr>
<td>29</td>
<td>-0.16442</td>
<td>-1.12465</td>
<td>-0.75138</td>
<td>-0.36147</td>
<td>0.06399</td>
<td>0.34253</td>
<td>0.84446</td>
</tr>
<tr>
<td>33</td>
<td>-0.13173</td>
<td>-1.22257</td>
<td>-0.77259</td>
<td>-0.27181</td>
<td>0.17964</td>
<td>0.39322</td>
<td>0.90373</td>
</tr>
<tr>
<td>42</td>
<td>0.46652</td>
<td>-1.09987</td>
<td>-0.47536</td>
<td>0.03144</td>
<td>0.87918</td>
<td>1.38738</td>
<td>2.07634</td>
</tr>
<tr>
<td>44</td>
<td>-0.38416</td>
<td>-1.57384</td>
<td>-1.12558</td>
<td>-0.65698</td>
<td>-0.09788</td>
<td>0.28067</td>
<td>0.86865</td>
</tr>
</tbody>
</table>

Items 26, 29, and 33 had moderate location parameters. The location parameter for item 44 is low, which means many examinees endorsed positive functioning in the area of perceived instructor efficacy on this item. This suggests examinees were more likely to believe that their instructor motivated them to do well in the class. However, item 42 had a high location parameter, which indicates that few examinees endorsed positive functioning in the area of perceived instructor efficacy on this item. This suggests that examinees were less likely to perceive their instructor as a good teacher. The category thresholds for the items are appropriate.

Table 4.25

Concentration Subscale Overall Item Endorsement Level & Category Thresholds

<table>
<thead>
<tr>
<th>Item</th>
<th>λ</th>
<th>β₁</th>
<th>β₂</th>
<th>β₃</th>
<th>β₄</th>
<th>β₅</th>
<th>β₆</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>0.50954</td>
<td>-0.80604</td>
<td>-0.13111</td>
<td>0.41627</td>
<td>0.75835</td>
<td>1.08165</td>
<td>1.73812</td>
</tr>
<tr>
<td>7</td>
<td>0.40166</td>
<td>-0.94422</td>
<td>-0.26024</td>
<td>0.19696</td>
<td>0.60488</td>
<td>1.00603</td>
<td>1.80655</td>
</tr>
<tr>
<td>19</td>
<td>0.37899</td>
<td>-1.04781</td>
<td>-0.3429</td>
<td>0.26801</td>
<td>0.68016</td>
<td>1.05398</td>
<td>1.66250</td>
</tr>
<tr>
<td>25</td>
<td>0.25770</td>
<td>-1.10787</td>
<td>-0.48626</td>
<td>0.16677</td>
<td>0.57246</td>
<td>0.9264</td>
<td>1.47470</td>
</tr>
</tbody>
</table>

All the location parameters for the Concentration subscale items were high and the category thresholds are appropriate. Many examinees endorsed positive functioning in the area of concentration. This indicates that examinees were less likely to indicate that it was easy to keep their mind from wandering, had an easy time concentrating, and were not easily distracted in class.
Table 4.26

*External Motivation/Future Subscale Overall Item Endorsement Level & Category Thresholds*

<table>
<thead>
<tr>
<th>Item</th>
<th>$\lambda$</th>
<th>$\beta_1$</th>
<th>$\beta_2$</th>
<th>$\beta_3$</th>
<th>$\beta_4$</th>
<th>$\beta_5$</th>
<th>$\beta_6$</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>0.0619</td>
<td>-1.0884</td>
<td>-0.58827</td>
<td>-0.31456</td>
<td>0.36408</td>
<td>0.76614</td>
<td>1.23241</td>
</tr>
<tr>
<td>23</td>
<td>0.13885</td>
<td>-0.76511</td>
<td>-0.37326</td>
<td>-0.14184</td>
<td>0.32587</td>
<td>0.69613</td>
<td>1.09132</td>
</tr>
<tr>
<td>46</td>
<td>0.00543</td>
<td>-1.02136</td>
<td>-0.58777</td>
<td>-0.3267</td>
<td>0.21293</td>
<td>0.65887</td>
<td>1.09661</td>
</tr>
<tr>
<td>51</td>
<td>0.04388</td>
<td>-1.02822</td>
<td>-0.56627</td>
<td>-0.26987</td>
<td>0.19078</td>
<td>0.70753</td>
<td>1.22933</td>
</tr>
</tbody>
</table>

All of the External Motivation Future items had moderate location parameters and many of the location parameters were close to zero. This indicates individuals were not more likely or less likely to endorse positive functioning in the area of external motivation future. The category thresholds for these items are appropriate.

Table 4.27

*Socializing Subscale Overall Item Endorsement Level & Category Thresholds*

<table>
<thead>
<tr>
<th>Item</th>
<th>$\lambda$</th>
<th>$\beta_1$</th>
<th>$\beta_2$</th>
<th>$\beta_3$</th>
<th>$\beta_4$</th>
<th>$\beta_5$</th>
<th>$\beta_6$</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>-0.25903</td>
<td>-1.62108</td>
<td>-0.99668</td>
<td>-0.23434</td>
<td>0.09041</td>
<td>0.3848</td>
<td>0.82272</td>
</tr>
<tr>
<td>20</td>
<td>-0.44868</td>
<td>-1.69189</td>
<td>-1.13114</td>
<td>-0.52701</td>
<td>-0.14223</td>
<td>0.14727</td>
<td>0.65293</td>
</tr>
<tr>
<td>45</td>
<td>-0.62770</td>
<td>-1.63584</td>
<td>-1.19916</td>
<td>-0.73655</td>
<td>-0.39442</td>
<td>-0.12839</td>
<td>0.32816</td>
</tr>
<tr>
<td>54</td>
<td>-0.62750</td>
<td>-2.69077</td>
<td>-1.7886</td>
<td>-0.83608</td>
<td>-0.04651</td>
<td>0.42071</td>
<td>1.17625</td>
</tr>
</tbody>
</table>

Almost all of the items on the Socializing subscale have low location parameters, which indicates many examinees endorsed positive functioning in the area of socializing (i.e. items 20, 45, and 54). This suggests that examinees were more likely to indicate their grades did not suffer because of one's social life, did not get behind in class because of spending too much time with friends, and their drinking behaviors did not interfere with studying. Item 15 had a moderate location parameter. The category threshold for the items on the Socializing subscale are appropriate.
Table 4.28

Career Decidedness Subscale Overall Item Endorsement Level & Category Thresholds

<table>
<thead>
<tr>
<th>Item</th>
<th>$\lambda$</th>
<th>$\beta_1$</th>
<th>$\beta_2$</th>
<th>$\beta_3$</th>
<th>$\beta_4$</th>
<th>$\beta_5$</th>
<th>$\beta_6$</th>
</tr>
</thead>
<tbody>
<tr>
<td>59</td>
<td>-0.26684</td>
<td>-1.16833</td>
<td>-0.79483</td>
<td>-0.50102</td>
<td>-0.1416</td>
<td>0.23352</td>
<td>0.77122</td>
</tr>
<tr>
<td>60</td>
<td>-0.3396</td>
<td>-1.2509</td>
<td>-0.87622</td>
<td>-0.57354</td>
<td>-0.23275</td>
<td>0.17579</td>
<td>0.72002</td>
</tr>
<tr>
<td>61</td>
<td>-1.11037</td>
<td>-2.32662</td>
<td>-1.84767</td>
<td>-1.38201</td>
<td>-0.73848</td>
<td>-0.43715</td>
<td>0.0697</td>
</tr>
<tr>
<td>62</td>
<td>0.39286</td>
<td>-16.53907</td>
<td>-10.00761</td>
<td>-4.78603</td>
<td>4.38629</td>
<td>9.41655</td>
<td>19.88703</td>
</tr>
</tbody>
</table>

Item 59 had a moderate location parameter. Items 60 and 61 have low location parameters indicating that many examinees endorsed positive functioning in career decidedness on these items. In particular, item 61 had a very low location parameter, which suggests most examinees endorsed positive functioning on this item and are not having a hard time choosing a major. Item 60 suggests that examinees were more likely to indicate they know what they want to do after they graduate. On the other hand, item 62 has a high location parameter, which suggests that examinees were less likely to believe their major is a good fit for them. After examination of the category thresholds for item 62, there is a large disparity in responses according to the amount of the career decidedness trait one possesses. The Item Category Curve for item 62 (see Appendix B) indicates that the response curves are straight lines rather than curved. This means no matter the amount of external motivation future one possesses, he/she would have a tendency to answer with any of the response options. Therefore, straight response curves make the interpretation of the category thresholds and the location parameter of item 62 difficult and inappropriate. The category thresholds for items 59, 60, and 61 are reasonable.

Table 4.29

Lack of Anxiety Subscale Overall Item Endorsement Level & Category Thresholds

<table>
<thead>
<tr>
<th>Item</th>
<th>$\lambda$</th>
<th>$\beta_1$</th>
<th>$\beta_2$</th>
<th>$\beta_3$</th>
<th>$\beta_4$</th>
<th>$\beta_5$</th>
<th>$\beta_6$</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>1.12546</td>
<td>-1.00911</td>
<td>0.11797</td>
<td>0.95178</td>
<td>1.68929</td>
<td>2.15607</td>
<td>2.84676</td>
</tr>
<tr>
<td>18</td>
<td>0.34660</td>
<td>-1.12046</td>
<td>-0.45235</td>
<td>0.19045</td>
<td>0.73407</td>
<td>1.11261</td>
<td>1.61528</td>
</tr>
<tr>
<td>37</td>
<td>0.81133</td>
<td>-1.05306</td>
<td>-0.14522</td>
<td>0.61443</td>
<td>1.30669</td>
<td>1.73451</td>
<td>2.41063</td>
</tr>
</tbody>
</table>
All the items on the Lack of Anxiety subscale had high location parameters, which indicate that few examinees endorsed positive functioning in the area of lack of anxiety. The category thresholds appear appropriate. The high location parameters on this scale suggest that examinees become anxious while studying and had test anxiety. Item 5 had a particularly high location parameter indicating that most examinees were nervous for exams, even if they prepared well.

Table 4.30

*Personal Adjustment Subscale Overall Item Endorsement Level & Category Thresholds*

<table>
<thead>
<tr>
<th>Item</th>
<th>$\lambda$</th>
<th>$\beta_1$</th>
<th>$\beta_2$</th>
<th>$\beta_3$</th>
<th>$\beta_4$</th>
<th>$\beta_5$</th>
<th>$\beta_6$</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>1.65121</td>
<td>-5.69304</td>
<td>-2.11341</td>
<td>-0.30747</td>
<td>2.27121</td>
<td>5.82017</td>
<td>9.92998</td>
</tr>
<tr>
<td>30</td>
<td>-0.17608</td>
<td>-1.33625</td>
<td>-0.85661</td>
<td>-0.33429</td>
<td>0.17435</td>
<td>0.40948</td>
<td>0.88684</td>
</tr>
<tr>
<td>50</td>
<td>-0.18332</td>
<td>-1.26367</td>
<td>-0.7951</td>
<td>-0.3044</td>
<td>0.1159</td>
<td>0.3628</td>
<td>0.78455</td>
</tr>
</tbody>
</table>

Items 30 and 50 on the Personal Adjustment subscale had moderate location parameters and the category thresholds are appropriate. However, item 2 had a high location parameter, which suggests that examinees were less likely to indicate that personal problems did not keep them from doing well in class. The Item Category Curve for item 2 (see Appendix B) indicates that the response curves are straight lines rather than curved. This means no matter the amount of personal adjustment one possesses, he/she would have a tendency to answer with any of the response options. Therefore, straight response curves make the interpretation of the category thresholds and the location parameter of item 2 difficult and inappropriate.

Table 4.31

*External Motivation/Current Subscale Overall Item Endorsement Level & Category Thresholds*

<table>
<thead>
<tr>
<th>Item</th>
<th>$\lambda$</th>
<th>$\beta_1$</th>
<th>$\beta_2$</th>
<th>$\beta_3$</th>
<th>$\beta_4$</th>
<th>$\beta_5$</th>
<th>$\beta_6$</th>
</tr>
</thead>
<tbody>
<tr>
<td>31</td>
<td>0.37083</td>
<td>-6.44662</td>
<td>-3.93189</td>
<td>-2.58177</td>
<td>0.81235</td>
<td>4.94647</td>
<td>9.42644</td>
</tr>
<tr>
<td>32</td>
<td>0.63755</td>
<td>-1.44519</td>
<td>-0.67545</td>
<td>-0.11903</td>
<td>1.00154</td>
<td>1.9919</td>
<td>3.07153</td>
</tr>
<tr>
<td>49</td>
<td>-2.68461</td>
<td>-4.67609</td>
<td>-4.15033</td>
<td>-3.52418</td>
<td>-2.39194</td>
<td>-1.34825</td>
<td>-0.01686</td>
</tr>
</tbody>
</table>

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Items 31 and 32 have high location parameters, which indicate that few examinees endorse positive functioning in the area of external motivation current. This suggests that examinees were less likely to believe they were trying to get good grades for external reason and worked hard so they could look smart to others. However, item 49 has a particularly low location parameter, which indicates that most of the examinees endorse positive functioning in external motivation/current on this item. This suggests that examinees were more likely to believe they needed a good grade to keep up their GPA. The category thresholds for item 32 and 49 appear reasonable.

After examination of the category thresholds for item 31, there is a large disparity in responses according to the amount of external motivation current trait individuals possessed. The Item Category Curve for item 31 (see Appendix B) indicates that the response curves are straight lines rather than curved. This means no matter the amount of external motivation future one possesses, he/she would have a tendency to answer with any of the response options. Therefore, straight response curves make the interpretation of the category thresholds and the location parameter of item 31 difficult and inappropriate.

Research question three

The aim of the last research question was to investigate the discriminating properties of the ASICS items. The following is a review of IRT slope parameters according to Embretson and Reise (2000). The slope of an item is used to determine an item's ability to discriminate between individuals possessing varying levels of a trait (Embretson & Reise, 2000; Stump, 2010). The slope is the steepness or the shape of a response curve. The higher the slope and more peaked a response curve appears, the narrower its width on the trait scale and the better the item. The less area a response curve covers on the trait scale, the more specific that response is to individuals who possess a certain amount of the trait being measured. Thus, there is a smaller range of individuals who answer with that response and, therefore, that response option can distinguish between different levels of the trait. The less peaked/steepest a response curve appears, the wider its width on the trait scale. The more area a response curve covers on the trait scale, the larger the range of individuals who tend to answer with that response. Thus, the response option does not distinguish between different levels of a trait since one's trait level does not appear to influence the way one responds (Embretson & Reise, 2000).
For polytomous items, there are multiple response curves per item, thus there are multiple slopes (Embretson & Reise, 2000). An alpha level ($\alpha$) is used to determine the overall slope of an item, which takes into consideration all the response curve slopes for an item. This helps answer the question of whether the item, in general, can discriminate between examinees with different trait levels. In the present study, each item's alpha level was evaluated and items with slope parameters ($\alpha$) below 1.0 were considered to be less discriminatory because the response curves are flatter and cannot detect variations in the subscale trait. Items with slope parameters greater than 1.0 were considered more discriminatory because the response curves are more peaked and can detect variations in the subscale trait (Embretson & Reise, 2000).

Figure 4.4 and Figure 4.5 are examples of items with high and low slope parameters. Figure 7 has the ability to discriminate between varying levels of the general academic skills trait ($\alpha = 1.598$). The category response curves for Figure 4.4 are steep enough to discriminate between examinees with varying levels of the academic general skills trait. As one can see, the different response options tend to be endorsed by individuals possessing a certain amount of the trait. In contrast, Figure 4.5 represents an item that does not discriminate between varying levels of the trait it is intended to measure. The item in Figure 8 has an alpha level close to zero ($\alpha = 0.044$) and the category response curves are not peaked. In fact, the category response curves have no steepness and are straight lines. Examinees with varying levels of the trait have almost the same likelihood of providing any of the response options (Embretson & Reise, 2000).

![Item Characteristic Curve: 0008 Graded Response Model (Logistic Metric)](image)

**Figure 4.4.** Example of an item with a high slope parameter (item 41).
Figure 4.5. Example of an item with a very low slope parameter (item 62).

As previously mentioned, the present study used a Logistic Graded Response Model analysis, which impacts how the response curves' shapes are formed. Unlike other IRT analyses, the slopes of the response curves are not fixed but are allowed to vary in a Logistic Graded Response Model analysis (Embretson & Reise, 2000). Thus, the shape or the steepness of each response curve varies and the slope for each curve is different. This helps provide more accurate information on how much of a trait individuals tend to possess to answer with a certain response option. In turn, the overall slope index (α) better represents the shape and discriminating ability of an item (Embretson & Reise, 2000). Table 4.32 through Table 4.41 represents the slopes for each of the ASICS items.

Table 4.32

<table>
<thead>
<tr>
<th>General Academic Skills Subscale Slope Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Items</td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td>Item 06</td>
</tr>
<tr>
<td>Item 10</td>
</tr>
<tr>
<td>Item 14</td>
</tr>
<tr>
<td>Item 16</td>
</tr>
<tr>
<td>Item 28</td>
</tr>
<tr>
<td>Item 36</td>
</tr>
<tr>
<td>Item 39</td>
</tr>
<tr>
<td>Item 41</td>
</tr>
</tbody>
</table>
Table 4.32 - continued

<table>
<thead>
<tr>
<th>Item</th>
<th>β</th>
<th>S.E.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item 55</td>
<td>1.007</td>
<td>0.026</td>
</tr>
<tr>
<td>Item 56</td>
<td>1.211</td>
<td>0.030</td>
</tr>
<tr>
<td>Item 57</td>
<td>1.282</td>
<td>0.031</td>
</tr>
<tr>
<td>Item 58</td>
<td>1.296</td>
<td>0.031</td>
</tr>
</tbody>
</table>

According to the slope parameters (α), many of the items on the General Academic Skills subscale can discriminate between individuals who possess a high amount of the general academic skills trait and individuals who possess a low amount of the trait. However, item 6 has a small slope parameter (α = 0.496) and cannot discriminate between varying levels of the trait.

Table 4.33

| Internal Motivation/Confidence Subscale Slope Index |
|---------------------------------|-----|------|
| Items                           | α   | S.E. |
| Item 08                         | 0.447 | 0.011 |
| Item 11                         | 0.543 | 0.014 |
| Item 12                         | 0.752 | 0.019 |
| Item 13                         | 1.169 | 0.03  |
| Item 22                         | 0.573 | 0.015 |
| Item 24                         | 0.534 | 0.015 |
| Item 34                         | 4.828 | 0.136 |
| Item 35                         | 5.578 | 0.161 |

After evaluating the slope parameters for the Internal Motivation subscale, many items have small alpha levels. Items 8, 11, 12, 22, and 24 have slope parameters below 1.0 and would be considered less discriminatory of individuals who possess a high amount of internal motivation and individuals who possess a low amount of internal motivation. However, items 34 and 35 have very large slope parameters and can discriminate between varying levels of internal motivation very well.
Table 4.34

*Perceived Instructor Efficacy Subscale Slope Index*

<table>
<thead>
<tr>
<th>Items</th>
<th>$\alpha$</th>
<th>S.E.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item 26</td>
<td>2.915</td>
<td>0.077</td>
</tr>
<tr>
<td>Item 29</td>
<td>2.931</td>
<td>0.078</td>
</tr>
<tr>
<td>Item 33</td>
<td>2.068</td>
<td>0.053</td>
</tr>
<tr>
<td>Item 42</td>
<td>1.008</td>
<td>0.025</td>
</tr>
<tr>
<td>Item 44</td>
<td>1.507</td>
<td>0.038</td>
</tr>
</tbody>
</table>

All the items on the Perceived Instructor Efficacy subscale had alpha levels greater than 1.0. Therefore, these items are able to discriminate between varying level of the perceived instructor efficacy trait.

Table 4.35

*Concentration Subscale Slope Index*

<table>
<thead>
<tr>
<th>Items</th>
<th>$\alpha$</th>
<th>S.E.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item 04</td>
<td>1.457</td>
<td>0.036</td>
</tr>
<tr>
<td>Item 07</td>
<td>1.806</td>
<td>0.044</td>
</tr>
<tr>
<td>Item 19</td>
<td>1.505</td>
<td>0.037</td>
</tr>
<tr>
<td>Item 25</td>
<td>1.659</td>
<td>0.041</td>
</tr>
</tbody>
</table>

After evaluating the slope parameters of the Concentration subscale, all the items had alpha levels above 1.0. This indicates that all the items on the subscale are able to discriminate between varying levels of the concentration trait.
Table 4.36

**External Motivation/ Future Subscale Slope Index**

<table>
<thead>
<tr>
<th>Items</th>
<th>α</th>
<th>S.E.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item 09</td>
<td>1.210</td>
<td>0.031</td>
</tr>
<tr>
<td>Item 23</td>
<td>2.404</td>
<td>0.063</td>
</tr>
<tr>
<td>Item 46</td>
<td>2.039</td>
<td>0.052</td>
</tr>
<tr>
<td>Item 51</td>
<td>1.436</td>
<td>0.036</td>
</tr>
</tbody>
</table>

All the items on the External Motivation Future subscale had high discriminatory levels. Each item has a large slope parameter and an alpha level greater than 1.0. Therefore, the items on the External Motivation Future subscale are able to discriminate between individuals who possess different amounts of the external motivation future trait.

Table 4.37

**Socializing Subscale Slope Index**

<table>
<thead>
<tr>
<th>Items</th>
<th>α</th>
<th>S.E.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item 15</td>
<td>1.324</td>
<td>0.034</td>
</tr>
<tr>
<td>Item 20</td>
<td>1.803</td>
<td>0.046</td>
</tr>
<tr>
<td>Item 45</td>
<td>2.344</td>
<td>0.065</td>
</tr>
<tr>
<td>Item 54</td>
<td>0.470</td>
<td>0.013</td>
</tr>
</tbody>
</table>

Most of the items in the Socializing subscale have large slope parameters (α > 1.0) and can discriminate between individuals who possess different amounts of the socializing trait. However, item 54 has a small slope parameter (α = 0.470), which suggests that the item does not discriminate well between varying levels of the socializing trait.
Table 4.38

Career Decidedness Subscale Slope Index

<table>
<thead>
<tr>
<th>Items</th>
<th>α</th>
<th>S.E.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item 59</td>
<td>3.444</td>
<td>0.094</td>
</tr>
<tr>
<td>Item 60</td>
<td>3.731</td>
<td>0.102</td>
</tr>
<tr>
<td>Item 61</td>
<td>0.886</td>
<td>0.027</td>
</tr>
<tr>
<td>Item 62</td>
<td>0.044</td>
<td>0.001</td>
</tr>
</tbody>
</table>

After evaluating the slope parameters of the Career Decidedness subscale, item 59 and item 60 had very large slope parameters. This indicates that these items easily discriminate between varying levels of the career decidedness trait. However, items 61 and items 62 had small slope parameters, which suggest that these items do not discriminate between individuals with varying levels of career decidedness.

Table 4.39

Lack of Anxiety Subscale Slope Index

<table>
<thead>
<tr>
<th>Items</th>
<th>α</th>
<th>S.E.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item 05</td>
<td>0.635</td>
<td>0.016</td>
</tr>
<tr>
<td>Item 18</td>
<td>1.603</td>
<td>0.04</td>
</tr>
<tr>
<td>Item 37</td>
<td>0.939</td>
<td>0.021</td>
</tr>
</tbody>
</table>

Some of the items on the Lack of Anxiety subscale had slope parameters smaller than 1.0 (items 05 and 37). This indicates that these items are not able to discriminate between varying levels of the lack of anxiety trait. However, item 18 has a large slope parameter, indicating that item 18 can discriminate among different levels of the lack of anxiety trait.
Table 4.40

*Personal Adjustment Subscale Slope Index*

<table>
<thead>
<tr>
<th>Items</th>
<th>α</th>
<th>S.E.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item 02</td>
<td>0.101</td>
<td>0.003</td>
</tr>
<tr>
<td>Item 30</td>
<td>2.124</td>
<td>0.054</td>
</tr>
<tr>
<td>Item 50</td>
<td>2.182</td>
<td>0.056</td>
</tr>
</tbody>
</table>

For the Personal Adjustment subscale, two of the items have large slope parameters (i.e. items 30 and 50), which indicates that these items can discriminate between different levels of the personal adjustment trait fairly well. However, item 2 has a low slope parameter (α = 0.101). As a result, this suggests that item 2 does not discriminate between individuals who possess a high amount of personal adjustment and individuals who possess a low amount of personal adjustment.

Table 4.41

*External Motivation/Current Subscale Slope Index*

<table>
<thead>
<tr>
<th>Items</th>
<th>α</th>
<th>S.E.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item 31</td>
<td>0.093</td>
<td>0.003</td>
</tr>
<tr>
<td>Item 32</td>
<td>0.585</td>
<td>0.015</td>
</tr>
<tr>
<td>Item 49</td>
<td>0.469</td>
<td>0.015</td>
</tr>
</tbody>
</table>

After evaluating the slope parameters of the External Motivation Current subscale, all of the items had small alpha levels (α < 1.0). This suggests that the subscale items do not differentiate between individuals who possess a high amount of the external motivation-current trait and individuals who possess a low amount of the external motivation-current trait.
CHAPTER FIVE

DISCUSSION

This chapter will discuss the study's findings and provide conclusions according to the research questions, academic success theory, test construction principles, and Item Response Theory. The aim of the present study was to investigate the following research questions: 1) What is the degree of the individual item fit for the employed IRT model? 2) What are the item and category difficulties and their spread? and 3) What are the discriminating properties of each individual item? The function of the ASICS items is discussed below in regards to item fit, difficulty/endorsement, and discrimination.

Item Fit

The first research question was aimed to investigate the degree of item fit to the employed IRT model. The PARSACLE program was used to evaluate item fit, which examines both the observed item category curves (empirical model) and the hypothesized item category curves (expected model). The expected model represents the ideal Item Category Curve for an item with sound psychometric structure (Embretson & Reise, 2000). The Item Category Curves are developed based upon the IRT analysis that was employed, which was a Logistic Graded Response Model. The Logistic Graded Response Model is used for unidimensional inventories with polytomous items (Embretson & Reise, 2000). Since a multidimensional IRT analysis could not be performed (discussed further below), a Logistic Graded Response Model was conducted on each of the ASIC subscales. This type of IRT analysis allows the response curves slopes to vary and category thresholds to be different item to item (Embretson & Reise, 2000). Item fit provides insight into item's psychometric structure, the appropriateness of the IRT analysis used, and the data (Embretson & Reise, 2000).

The findings indicate that none of the ASICS items fit the expected IRT model. Thus, there was a significant difference between the empirical model and the expected model for each ASICS item. According to Embretson and Reise (2000), poor item fit may be due to one or more of the following: poor item construction, item responses were not accurately explained by the analysis, unaccounted multidimensionality, and issues of nonmonotonicity (i.e., the trait level does not increase in a linear progression).
First, the lack of item fit may suggest that the ASICS items are poorly constructed (Embretson & Reise, 2000). Since all the items did not fit the model, this suggests that the structure of the item may not be appropriate. All the items use a 7-point Likert scale. There is a debate in the test construction literature whether smaller or larger Likert scales are more sufficient (Dawes, 2008). Some experts believe that there are negligible differences between the points on a large Likert scale; therefore smaller Likert scales (e.g. 4- or 5-point Likert scales) are more appropriate. However, others believe that larger Likert scales detect varying difference in the trait being measured (Dawes, 2008). Future research could further investigate the effectiveness of a smaller or larger Likert scale for measuring the ASICS subscale traits.

According to Embretson and Reise (2000) poor item fit may also indicate that the data analysis does not represent or explain the data well. The ASICS is a ten factor multidimensional inventory with polytomous items. A multidimensional IRT analysis would have been the most appropriate IRT analysis for the inventory. However, since multidimensional IRT analyses are fairly new, there is no software available to perform a multidimensional analysis on a ten factor scale. Therefore, the present study had to utilize a unidimensional analysis to evaluate the items according to their respective subscales. The poor fit statistics may confirm that the Logistic Graded Response Model was not the most appropriate analysis for the data and does not effectively explain item responses. This suggests that future studies should reanalyze the data using a multidimensional IRT because it may better explain the data.

Poor item fit may also suggest issues with the data, such as unaccounted multidimensionality or issues of nonmonotonicity (Embretson & Reise, 2000). However, an issue of multidimensionality seems less likely for the present study. According to previous research, factor analysis indicates that there are ten separate factors measured by the ASICS (Prevatt et al., 2011); therefore, subscales measuring more than one trait seems unlikely because the factor analyses demonstrated a strong ten factor structure (Prevatt et al., 2011. IRT analyses assume monotonicity, which is the linear progression of the trait being measured (Embretson & Reise, 2000). Thus, as the trait level increases, the probability of endorsement also increases. It is possible that there are issues with nonmonotonicity, which is the nonlinear progression of the trait. Poor item fit may suggest that the probability of endorsement may not have a linear relationship with the subscale traits (Embretson & Reise, 2000).
The lack of item fit may be the result of programming rather than a flaw in the psychometric structure items or the inability for the Logistic Graded Response Model to explain the data. According to DeMars (2005), the PARSCALE software was developed for the increasing use of polytomous instruments. DeMars discovered that the PARSCALE software is at risk of providing type I error results (i.e. a false significant difference between the empirical model and the expected model). In particular, the study showed that type I error rates increase for shorter tests. Since the present study was performed on the ASICS subscales, subscale lengths ranged from 3 to 12 items. Therefore, the short subscale lengths and the use of the PARSCALE software may have contributed to the lack of item fit.

Finally, it is important to note that previous research has shown the ASICS to have sound psychometric properties and it was created according to appropriate scale development procedures (Prevatt et al., 2011). The ASICS items were originally developed by use of a review of the literature questionnaires sent to professors and undergraduate students (Prevatt et al., 2011). A pool of 72 Likert scale items was created and was reviewed by experts on college academic success who evaluated the content the items and reduced the pool to 62 items (Prevatt et al., 2011).

The ASICS was shown to have construct validity by assessing the factor structure underlining the instrument on a sample of 930 students who ranged in grade point averages (Prevatt et al., 2011; Welles, 2010). The Exploratory Factor Analysis indicated a strong ten factor structure. Evidence of criterion validity was shown by comparing ASICS results to student academic performance (Prevatt et al., 2011; Welles, 2010). In addition, the internal structure of the ASICS was examined by evaluating the internal consistency of the ten subscale scores and the Cronbach alphas indicate that the ASICS is a reliable measure (Prevatt et al., 2011). The subscale alpha levels range from .77 to .93, with exception for the External Motivation/Current Time subscale with a alpha level of .62 (Prevatt et al., 2011). Given the multifaceted support in favor of the scale, it would seem highly unlikely that not a single item out of 50 has a good fit. It is more likely that there is an issue with the IRT analysis rather than scale construction and development, especially because the ideal IRT analysis was not performed due to lack of appropriate software. In addition, the poor item fit may be due to the application of IRT to inventories that measure traits, attitudes, or personality characteristics. IRT was originally developed for achievement testing, but statisticians have recently applied the IRT approach to
scaled items (Embretson & Reise, 2000). As a result, the IRT analysis may not be best suited for items that are measuring constructs that are on a continuum verses constructs with a clearly defined right or wrong answer (e.g. achievement testing). Additional research needs to be performed on the appropriateness of applying an IRT analysis to inventories that measure attitudes, personality characteristic, or traits.

**Items with Strong Discrimination and Appropriate Endorsement Levels**

The ASICS items were also evaluated for their endorsement levels and discriminating properties. Even though the ASICS items did not fit the expected model, many of the items have other strong psychometric properties. These items have appropriate endorsement levels and can discriminate between varying levels of their respective subscale's trait. ASICS items with adequate discrimination and endorsement levels are listed in Table 5.1.

As a review from Embretson and Reise (2000), the location parameter ($\lambda_i$) is the score that is used to evaluate the endorsement/difficulty level of an item and represents the placement of the item on the latent trait continuum. Items with location parameters near 0 indicate that the item is placed on the middle of the trait scale and has appropriate endorsement. Thus, individuals who possess a high amount of a trait tend to provide answers of positive functioning and individuals who possess a low amount of a trait tend to provide answers of poor functioning. Items with high location parameters suggest examinees were less likely to endorse positive functioning and few examinees scored with a response option indicating positive functioning. Items with low location parameters suggest examinees were more likely to endorse positive functioning and many examinees scored with a response option indicating positive functioning.

The slope of an item is used to determine an item's ability to discriminate between individuals possessing varying levels of the subscale trait (Embretson & Reise, 2000; Stump, 2010). Slopes above 1.0 indicate that the item is sensitive enough to detect differences in test-takers' levels of the trait being measured by the subscale. Therefore, the higher the alpha level the better the item is to detect differences in the subscale trait (Embretson & Reise, 2000).
### Table 5.1

**Items with Adequate Discrimination and Endorsement Levels**

**General Academic Skills Subscale**
- Item 14- I tried everything I could to do well in this class
- Item 28- I kept on a good study schedule in this class
- Item 36- I worked hard in this class because I wanted to understand the material
- Item 41- I think I used good study skills when working in this class
- Item 55- I made good use of tools such as planners, calendars and organizers in this class
- Item 57- I was good at setting specific homework goals
- Item 58- I was well organized

**Internal Motivation/Confidence Subscale**
- Item 13- I was pretty sure I could make an A or B in this class
- Item 34- I was pretty sure I would get a good grade in this class
- Item 35- I felt pretty confident in my skills and abilities in this class

**Perceived Instructor Efficacy Subscale**
- Item 26- I was disappointed with the quality of the teaching
- Item 29- I did poorly because the instructor was not effective
- Item 33- I would have done better if my instructor were better

**Concentration Subscale**
- Item 25- I got easily distracted in this class

**External Motivation/Future Subscale**
- Item 09- I needed to do well in this class to get a good job later on)
- Item 23- This class will be very useful to me in my career
- Item 46- This class is important to my future success
- Item 51- I think in the future I will really use the material I learned in this class

**Socializing Subscale**
- Item 15- Sometimes I partied when I should have been studying

**Career Decidedness Subscale**
- Item 59- I am certain about what occupation I want after I graduate

**Lack of Anxiety Subscale**
- No items

**Personal Adjustment Subscale**
- Item 30- I would have done much better if I didn't have to deal with other problems in my life
- Item 50- I had some personal difficulties that affected my performance in this class
The strong psychometric properties of the items above indicate that the item statements accurately represent the subscale trait it is intended to measure. As such, there is a wealth of information regarding the ten factors measured by the ASIC that is demonstrated by the item results. The items with adequate discrimination and endorsement indicate that the item statements can detect varying levels of the subscale trait it is measuring and examinees did not tend to under-endorse or over-endorse the item. Based on IRT results, it was discovered that the general academic skills trait is represented by the following: trying everything one could do to perform well, keeping a good study schedule, working hard to understand the material, using good study skills, use of a planner/organizer, setting specific homework goals, and being well organized.

The items on the Internal Motivation/Confidence subscale with adequate endorsement and discrimination suggest that students who were internally motivated are confident they could obtain a good grade (e.g., A or B) in their most difficult class and are confident in their skills/abilities. IRT results also indicated that perceived instructor efficacy can be determined by whether or not students were disappointed with the quality of their instructor's teaching, whether students performed poorly because the instructor was not effective, and whether students believed they would have done better if they had a better instructor. Moreover, students with high concentration skills were not easily distracted in their most difficult class.

All the items on the External Motivation-Future subscale had adequate discrimination and endorsement. IRT results indicate that external motivation can be determined by future-orientated factors, such as believing they needed to perform well so they can get a good job, finding the course material to be useful in the future, needing the course for one's future career, and the course material could make them successful in the future.

Finally, IRT results also indicate that assessing whether students were partying when they should have been studying accurately represents the socializing trait. Students high in career decidedness are certain about what occupation they want after they graduate. Moreover, item statements regarding students doing better if they did not have to deal with life problems and
personal difficulties affecting academic performance accurately represented the personal adjustment trait.

**Items with Inadequate Discrimination or Endorsement levels**

Even though many of the ASICS items have strong psychometric properties, some of the items had notably weak psychometric properties due to inadequate endorsement levels ($\lambda < -0.3$ and $\lambda > 0.3$), lack of discrimination ($\alpha < 1.0$), or both. These items include are shown in the table below (Table 5.2).

Table 5.2

<table>
<thead>
<tr>
<th>ASICS Items with Inadequate Discrimination or Endorsement Levels</th>
<th>$\lambda$</th>
<th>$\alpha$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General Academic Skills Subscale</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>06. I studied the correct material when preparing for tests in this class</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>10. I worked hard to prove I could get a good grade.</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>16. I worked really hard in this class.</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>39. I studied a lot for this class</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>56. I used a goal setting as a strategy in this class.</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td><strong>Internal Motivation/Confidence Subscale</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>08. I got satisfaction from learning new material in this class</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>11. I enjoyed the challenge of just learning for learning’s sake in this class</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>12. I felt confident I could understand even the most difficult material in this class</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>22. I knew that if I worked hard, I could do well in this class</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>24. I worried a lot about failing this class</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td><strong>Perceived Instructor Efficacy Subscale</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>42. The instructor in this class really motivated me to do well</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>44. Anything I learned, I learned on my own. The instructor in this class was not a good teacher</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td><strong>Concentration Subscale</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>04. It was easy to keep my mind from wandering in this class</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>07. I had an easy time concentrating in this class</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>19. I had a hard time concentrating in this class</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td><strong>External Motivation/Future Subscale</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No items</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 5.2 - continued

**Socializing Subscale**
20. My grades suffered because of my active social life  x  
45. I got behind in this class because I spent too much time partying or hanging out with my friends  x  
54. Sometimes my drinking behavior interfered with my studying  x  x  

**Career Decidedness Subscale**
60. I know what I want to do after I graduate  x  
61. I am having a hard time choosing a major  x  x  
62. I am certain that my major is a good fit for me  

**Lack of Anxiety Subscale**
5. I was nervous for tests even when I was well prepared  x  x  
18. Studying for this class made me anxious  x  
37. I got anxious when taking tests in this class  x  x  

**Personal Adjustment Subscale**
02. Personal problems kept me from doing well in this class  x  x  

**External Motivation/Current Time Subscale**
31. It was important to get a good grade in this class for external reasons  x  
32. I worked hard in this class because I wanted others to think I was smart  x  x  
49. I needed good grades in this class to keep up my GPA.  x  x  

Note: x represents inadequate endorsement or discrimination.

**General Academic Skills subscale**

The General Academic Skills subscale has 12 items and four of the items had questionable psychometric properties. Only one of the items had an inadequate discrimination and endorsement. However, four of the items had adequate discrimination, but an inappropriate endorsement level.

Item 6 is the only item in the General Academic Skills subscale that has both weak discrimination and inadequate endorsement. Many of the examinees endorsed the item and the item did not discriminate between varying levels of the general academic skills trait. One possible reason for the item's misfunction is that many students believe that they are studying the correct material for exams. Even the IRT results suggest students who were lower on the general academic skills tend to believe they were studying the correct information. Therefore, whether or
not a student believes they studied the correct material is not a good indication of the general academic skills trait.

Items 10, 16, and 39 had low location parameters, but adequate discrimination. Examinees were more likely to endorse positive functioning in general academic skills on these items. This means most examinees indicated they work hard and studied a lot. Even though these items were able to detect varying levels of general academic skill working hard and studying a lot may not be a strong indicator of general academic skills. Item 56 had a high location parameter and adequate discrimination meaning most examinees did not endorse positive functioning on this item. The results of this item indicate most students do not use goal setting strategies and students who tend to use goal setting strategies possess a significantly high amount of general academic skills. Therefore, assessing goal setting strategies may be a too specific technique of general academic skills and may not be broad enough to actually capture student's general academic skills ability.

**Internal Motivation/Confidence subscale**

The Internal Motivation/Confidence subscale has eight items and five of the items have questionable psychometric properties. Three of the items had inadequate endorsement and discrimination while two of the items had adequate endorsement, but inadequate discrimination.

Item 11 had inadequate discrimination and endorsement. This item did not detect varying levels of the internal motivation/confidence trait and was not endorsed by many students. Thus, this item may not accurately represent the trait of internal motivation. In the Organismic Integration Theory of SDT, students who have a strong interest in the subject matter will possess more internal motivation and will have better academic performance (Ryan, Connell, & Plant, 1990). However, item 11 does not specifically focus on one's interest in the subject, but one enjoying the learning challenge. Even though they are similar, *enjoyment from the learning challenge* may be a different concept than *interest* and may not accurately represent internal motivation.

Item 22 also had inadequate discrimination and endorsement. Most examinees endorsed item 22 and many students agreed with the statement. As a result, this item was not able to detect varying levels of internal motivation. The results of this item indicate that many students knew hard work was required to do well in the class. However, the actual *execution* of the hard work may be a better indicator of one's internal motivation. Item 24 had inadequate discrimination and
endorsement; however, when examining the Item Response Curve for item 24, the response curves are straight. Thus, this indicates that item responses were not influenced by one's internal motivation. Item 24 may be a weak item because the item includes an external factor, one's grade in the course. Based on the results of items 11, 22, and 24, enjoying the challenge of learning, knowing hard work is needed to do well, and worrying about one's grades are not strong indicators of internal motivation. Therefore, revision of these items is needed.

Both items 8 and 12 had appropriate endorsement levels; however, these items had inadequate discrimination. Item 8 was less discriminatory of individuals who possess internal motivation and individuals who do not possess internal motivation. When examining the Item Category Curve for item 8, the response curves are quite wide indicating that individuals with varying levels of internal motivation would provide a wide range of response options. Thus, one's level of internal motivation did not strongly contribute to how one answered item 8. This is contrary to previous research which found that intrinsic motivation is associated with learning (Benware & Deci, 1984; Deci et al., 1996; Gottfried 1985, Gottfried 1990, Lloyd & Barenblatt 1984; Jang, 2008; Ryan, Connell, & Plant, 1990; and Schiefele, 1991). Item 8 is similar to item 11 discussed above. It appears that both items focus on enjoyment or satisfaction from learning. However, much of the research on intrinsic motivation focuses on one's interest in the course material. Even though it is similar, interest may be a different concept than satisfaction from learning new material, which may not represent internal motivation well. Therefore, more research is needed in the field of intrinsic motivation, specifically in the area of satisfaction from learning. In addition, because the examinees answered the items in reference to their most difficult class, it may be beneficial to explore whether the class was for one's major.

Item 12 was less discriminatory of individuals who possess internal motivation/confidence and individuals who do not possess the trait. It appears that assessing whether students felt confident they could understand the most difficult information does not represent the internal motivation/confidence trait. Examinees already identified that the course they are answering ASICS items in regards to was their most difficult class. Therefore, there may not have been enough variations in item responses regarding students' understanding the most difficult material in their most difficult course.
Perceived Instructor Efficacy subscale

All five items on the Perceived Instructor Efficacy subscale had adequate discrimination; however, two of the items had inadequate endorsement. Items 42 and 44 are both on the Perceived Instructor Efficacy subscale and had a high location parameter indicating that examinees were less likely to endorse positive functioning on these items. According to item 42 results, examinees indicated that their instructor did not motivate them to perform well. The high location parameter for item 44 means examinees were less likely to endorse positive functioning on the item. Positive functioning on this item means students believed their professor was a good instructor and whatever they learned they learned from the instructor. Based on the results of these two items, it appears that students believed what they learned in the course they learned on their own and they had to motivate themselves to do well. According to Self-Determination Theory, autonomy is an important component of the learning process (Fortier, Vallerand, & Guay, 1995). Autonomous students possess more ownership and responsibility for their learning. These students also tend to have better academic performance (Fortier, Vallerand, & Guay, 1995). Thus, this may be a reason why students felt like they had to learn the material on their own and motivate themselves to do well.

Concentration subscale

All four items on the Concentration subscale had adequate discrimination; however, three of the items had inadequate endorsement levels. Items 4, 7, and 19 have high location parameters indicating examinees were less likely to endorse positive functioning on these items. Thus, examinees need to possess a high amount of the concentration trait in order to indicate they did not have a hard time concentrating in their most difficult class. According to Self-Regulation Theory (Zimmerman, 2001), regulating one's cognitions and focus is an important factor associate with self-regulated learning. It is possible that students in this study were overwhelmed by the challenge of their most difficult course and found it hard to pay attention. However, Self-Regulation Theory may not be applicable for the current college student population since much of the research in this area has been performed a decade ago. Due to the increased use of technology, students may have more distractions available to them. For example, students are able to bring their laptop computers to class and have access to information unrelated to the course materials. Students also have access to instant communication to individuals outside of
the classroom. Therefore, this may be a reason why students had a difficult time concentrating and would have a hard time paying attention regardless of the difficulty level of the course.

**External Motivation-Future subscale**

All four items on the External Motivation/Future subscale have adequate discrimination and endorsement levels.

**Socializing subscale**

There are four items on the Socializing subscale. One of the items had inadequate discrimination and endorsement, and two of the items had adequate discrimination with inadequate endorsement. Item 54 lacked in it's ability to discriminate between varying levels of the socializing trait and most of the examinees endorsed positive functioning (i.e. their drinking behavior did not interfere with their studying). The Item Category Curve for item 54 illustrates that the response curves are very wide indicating that examinees along the socializing continuum provided a wide range of responses. The difference between this item and the other socializing subscale items is that this item specifically addresses drinking behaviors. Therefore, drinking behaviors may not well represent the socializing trait because it may be too specific of a quality. In addition, examinees may be less likely to disclose drinking behaviors.

Items 45 and 20 had low location parameters with adequate discrimination. These items are able to detect varying levels of the socializing trait, but examinees are more likely to endorse positive functioning on these items. Thus, examinees only needed to possess a lower amount of the trait to endorse positive functioning on these items. There are two potential reasons for these results. First, it is possible that students who had inappropriate amounts of socializing did not perceive their socializing as a hindrance. On the contrary, students may have been academically engaged and their socializing was minimal. The latter reason would be related to Kuh's (2001a) Student Engagement Model, which suggests that the best indicator of academic success is the amount of time students put towards academically related activities.

**Career Decidedness subscale**

There are four items on the Career Decidedness Subscale and three of the items had questionable psychometric properties. Of these items, one of the items had inadequate endorsement and discrimination, one item had adequate discrimination with inadequate endorsement, and one item has inadequate discrimination with adequate endorsement.
Item 61 did not discriminate between varying levels of career decidedness and examinees were more likely to endorse positive functioning. Regardless of where one fell on the career decidedness scale, most examinees indicated they had an easy time choosing a major. As a result, this item did not differentiate between individuals with varying levels of career decidedness. When compared to the career decidedness item with strong psychometric properties, items that focused on a future career plan had high discrepancy when compared to items that only focus on one's major. These findings may suggest that future career plans may be a better indication of career decidedness than students finding a major.

Item 60 had a low location parameter with adequate discrimination. Thus, examinees were more likely to endorse positive functioning on this item. This means students tend to know what they would like to do after they graduate. However, compared to item 59 which had sound properties, it appears that students may know what they want to do after they graduate, but their plans may not be related to a specific occupation (e.g. going to graduate school, traveling, etc.). The Item Category Curve for items 62 is notable due to the straightness of the response curves. Even though the endorsement levels were appropriate, the straight lines of the response curves suggest that the endorsement levels do not provide much meaning. The flatness of the response curves indicate that these items do not detect any differences in the trait and the subscale trait was not a contributing factor to how individuals responded.

**Lack of Anxiety subscale**

For the Lack of Anxiety subscale, all three items had inadequate endorsement levels and two of the items also had inadequate discrimination. Items 5 and 37 had low discrimination and high location parameters. Examinees were less likely to endorse positive functioning on these items. Both items indicate that many students, regardless of where they fell on the lack of anxiety scale, were anxious while taking exams. These results are similar to item 24 on the Internal Motivation/Confidence subscale which indicated that most examinees were worried about their performance in the course. It appears that items 5 and 37 are not sensitive enough to detect variations of anxiety levels in college students and would benefit from being revised. Item 18 had adequate discrimination and a high location parameter. This means examinees were less likely to endorse positive functioning on this item. Therefore, IRT results indicate that studying for one's most difficult class tends to make students anxious.
**Personal Adjustment subscale**

The Personal Adjustment subscale has three items and item 2 was the only item on the Personal Adjustment subscale with questionable psychometric properties. Item 2 had inadequate discrimination and endorsement. The Item Category Curve for item 2 is notable due to the straightness of the response curves. The flatness of the response curves indicate that these items do not detect any differences in the trait and the subscale trait was not a contributing factor to how individuals responded. This is evident through the extremely low discrimination level and the extremely high endorsement level. Thus, examinees along the spectrum of personal adjustment provided a variety of responses to the item. Therefore, assessing whether or not personal problems kept students from doing well in this class may not be a good indicator of personal adjustment.

**External Motivation-Current Time subscale**

Finally, all three items on the External Motivation/Current subscale had questionable psychometric properties. All three items had inadequate discrimination and two of the items also had inadequate endorsement.

Item 49 did not discriminate between individuals with varying levels of external motivation current trait and most examinees endorsed positive functioning. It is possible that most examinees knew that getting a good grade in this class could help their GPA. Therefore, this item may not be strong enough to represent the trait of external motivation current. Item 32 did not discriminate between individuals with varying levels of external motivation current and most of the examinees did not endorse positive functioning. Therefore, assessing whether students worked hard in order for others to think they were smart may not be the best indicator of the external motivation current trait.

The Item Category Curves for items 31 is notable due to the straightness of the response curves. Even though the endorsement levels were appropriate, the discrimination was low and the straight lines of the response curves suggest that the endorsement levels do not provide much meaning. The flatness of the response curves indicate that these items do not detect any differences in the trait and the subscale trait was not a contributing factor to how individuals responded. This item is intended to measure the importance of getting a good grade in one's most difficult class for external reasons (e.g. parents, a scholarship, university regulations). The question includes external factors that would be motivating for high achievers (i.e. scholarship).
and low achievers (i.e. university regulations). For example, an honors student with a scholarship and a student who is on academic probation both have external reasons to achieve. Therefore, this may cause the wide range of responses from individuals across the external motivation current spectrum. In addition, the External Motivation/Current subscale had low reliability with a Cronbach alpha level of .62 (Prevatt et al., 2011), which may also explain some of the questionable properties of the subscale items.

**Limitations**

Even though there were a lot of strengths in the present study, there are some limitations that should be discussed. These limitations may impact the efficacy and findings of the study. First, the study did not use the best suited IRT analysis due to the lack of available software. The ASICS measures ten factors related to academic success; therefore, a multidimensional IRT analysis would have been best suited for the inventory. A multidimensional IRT analysis assumes that there is more than one trait being measured by an assessment and would be able to examine the overall concept of academic success by taking into consideration the ten ASICS factors. However, since multidimensional IRT is a newer procedure, there is no software available that could run a ten factor multidimensional IRT analysis. The present study was limited to performing ten separate unidimensional IRT analyses, which may impair the efficacy of the study. This may explain the poor item fit for each of the ASICS items. As stated earlier, poor item fit may be the result of the IRT analysis not being appropriate for the data. Since the data are multidimensional, the use of a unidimensional analysis may have caused the poor item fit.

In addition, Prevatt et al., (2011) demonstrated that the ASICS has strong psychometric properties. Many of the ASICS subscales have strong reliability (Prevatt et al., 2011); however, some of the properties of the subscales may have caused questionable results. The External Motivation Current subscale had a coefficient alpha of .62. The internal validity of this subscale may have compromised the External Motivation Current subscale results. Furthermore, some of the subscales had a limited number of items \(i < 5\). The latent trait continuum of a subscale is determined by participants' performance on the subscale items. A greater number of items on a subscale can better represent the trait and provide a more accurate representation of the trait being measured. Therefore, a greater number of items on the ASICS subscales may provide more
accurate item psychometric properties. In addition, according to De Mars (2005), the PARSCALE software is at risk of providing type I error results (i.e. a false significant difference between the empirical model and the expected model). In particular, the study showed that type I error rates increase for shorter tests. Therefore, the PARSCALE software is limited in its ability to provide accurate results for shorter scales.

Finally, the participants of the study may have impacted the validity of the study. Even though a benefit of performing an IRT analysis is that random sampling is not needed, all the participants in the present investigation were from a large southeastern public university who volunteered to be in the study. As a result, this may have influenced how participants responded to the ASICS items and may have impacted the findings. It is possible the findings would have been different if the sample was from students who attended a small private northeastern college.

**Suggestions for Future Research**

The present study results and findings gives direction for future studies and can help expand the literature on college academic success. First, as noted in the limitations section, there is a lack of software that can perform a multidimensional IRT analysis on a ten factor measure. Statisticians and computer programmers should collaborate to develop a program that can perform a multidimensional IRT analysis on inventories with a large number of factors. Once this occurs, replication of the current study is suggested and ASICS items should be analyzed using a multidimensional IRT. By performing a multidimensional IRT, the psychometric properties of the items will be based on the latent trait of academic success rather than the individual subscales. Therefore, multidimensional IRT results could provide a more accurate analysis of the academic success latent trait.

Future research could also reevaluate the item fit index of the individual ASICS items. As stated previously, the PARSCALE software is limited in its ability to provide accurate fit indexes with short tests, particularly short scales similar to the subscales of the ASICS. The fit of the items should be examined using different IRT software, in particular a multidimensional IRT software. Embretson and Reise (2000) suggest using multiple fit indexes when examining the complex issue of item fit. Therefore, multiple analyses of item fit should be used in future research and item fit should be performed by several different IRT programs.
Some of the items had inadequate discrimination, endorsement levels, or both (see Table 44). By revising these items, this could improve the psychometric properties of the subscales as well as the ASICS. The items with low discrimination may be revised in order to better detect the latent traits of the subscale. Future research could also investigate whether a smaller or larger point Likert scale is more appropriate for measuring the ASICS traits.

Finally, there is a need for an up-to-date theory of academic success. Higher education has changed substantially in the 21st century. For instance, the use of technology has changed the educational field. Students are able to bring laptop computers to class and have access to information outside of the classroom. Professors use power point presentations to guide their class lectures. Professors are also encouraged to use multimedia as part of their teaching methods, such as movie clips, the internet, etc. As a result, students are expected to be entertained in the classroom and none of the academic success theories address this change in education. Therefore, experts in higher education and psychology need to develop an up-to-date academic success theory. The results of the present study may reflect this change in education. For instance, many of the examinees indicate it was hard to concentrate in their most difficult class. This may be that the instructor may have not used technology as part of their teaching methods. In addition, many students indicated that they attributed their poor performance to the professor. This may also be the result of the instructor using traditional teaching methods that students were not accustomed to. Future research should further explore students' expectations for teaching and explore a new theory of college academic success.

**Implications for Practice**

There are many pragmatic uses for the ASICS and universities can find great utility for the inventory. The ASICS can be used as a screening instrument to identify a college student's strengths as well as weaknesses in academic performance. Since the ASICS is an online inventory, it can be administered to a large number of individuals. Universities can have their first-year students take the ASICS for early identification of weaknesses and prevent academic difficulties. Institutions can provide students with information about on-campus resources that can address difficulties in certain areas. For instance, college counseling centers can help address difficulties with motivation, personal adjustment, anxiety, and socializing. Career centers can help students find a career and increase external motivation. Tutoring services can assist with
general academic/study skills and increase ownership over one's academic performance. Centers and programs which evaluate students for attention deficits can provide academic coaching to increase concentration and time management skills. The ASICS can also be used to inform university faculty and staff about student population's needs and develop resources to help improve the campus's academic success.

An advantage of performing the present study is that it provided detailed information on hypothesized constructs measured by the ASICS. The psychometric properties of the individual items provide information on what aspects are related to the subscale traits and what does not influence the traits. Professionals can learn from how examinees responded to the statements of the ASICS items and adapt educational programming based on the present study results. For example, the results for the General Academic Skills subscale indicates that even though students may believe they are working hard and are studying the correct information, this may not be related to the quality of the study skills students used. Therefore, university faculty and staff should assess whether or not students are truly studying the correct material. IRT results showed that students with good study skills use goal-setting techniques, use planners and schedules, set homework goals, and are well organized.

Previous research has shown that both internal motivation and external motivation are important factors related to academic success (Ryan, Connell, & Plant, 1990; Jones, Llancer-Arrastia, & Newbill, 2009). The results of the present study show that students may not be motivated by the challenge of learning alone. However, internally motivated students are confident in their ability to perform in the class as well. As a result, when taking a difficult class, students' confidence level may impact their performance. Students may benefit from learning motivation building techniques. Students can use visualization, positive self-talk, and reflecting on past successes to increase their self-confidence. In addition, the study findings demonstrated that external motivators are important to students, specifically motivators that are future oriented (e.g. finding a job, needing a good grade for one's future career, etc.). Students may need to know how the course material and their performance will help them in the future. They may find it useful for professors and tutors to relate the course material to their future careers.

Some of the items that focused on test anxiety and students' worry about their performance did not differentiate between individuals well because many of the examinees indicated they were anxious about their performance. These results may indicate that regardless
of academic ability, students have a tendency to worry about their performance in their most
difficult class. College students may benefit from stress management and anxiety reduction
techniques so that their anxiety does not hinder their performance. For example, since many
students in the present study indicated they worried a lot about their performance, college
students may benefit from using cognitive restructuring, breathing techniques, and progressive
muscle relaxation.

When investigating the socializing subscale, responses varied based upon the wording of
the items. The item that focused on drinking behaviors specifically had weak psychometric
properties. However, the item that focused on socializing in general had better psychometric
properties. When professionals are trying to assess whether or not a student's social life is
impacting his or her academic performance, professionals should assess the impact of one's
social life in general rather than only focusing on one's drinking behaviors.

Finally, the findings of the present study provide further insight in career counseling
research. Items that focused on one's plans after college had stronger psychometric properties
compared to items that focused on students choosing a major. Academic advisors and career
counselors should be aware that students who have future career goals may have a greater
likelihood of performing better in college. Therefore, career counselors and academic advisors
should not only help students find a major, but should help students develop career goals in order
to be a motivator for them to perform well in college.

Summary

Graduating from college is a paramount stepping stone for individual achievement and
future success (Pritchard & Wilson, 2003). There are several benefits to attending college and
graduating with an undergraduate degree (U.S. Census Bureau, 2002; Ross & Mirowsky; 2010).
For example, there is consistent evidence in the higher education literature that attaining a post-
secondary degree is positively correlated with later employment and income (Pascarella &
Terenzini, 2005). As a result of college's significance and benefits, American society puts a large
investment into higher education (Census Bureau, 2007b; Department of Education, 2004).
However, almost 50% of individuals who enter college will drop out before receiving their
degree (Brawer, 1996). At least 15% of students who leave college do so as a result of a forced
academic dismissal (Kalsner, 1991). Moreover, many students who are struggling academically
end up leaving prematurely before a forced dismissal is warranted (Kalsner, 1991). Therefore, there is a great need to help students be successful at the post-secondary educational level.

There are varying schools of thought and theoretical perspectives regarding the academic success of college students. These theoretical perspectives include Self-Determination Theory, Achievement Goal Theory, Self-Regulation Theory, Input-Environment-Outcomes Model (I-E-O), Student Integration Model, and Kuh's Student Engagement Model (Deci & Ryan, 2000; Harackiewicz, Barron, Tauer, & Elliot, 2002; Zimmerman, 1986; Astin, 1993; Tinto, 1993; Kuh, 2001a). As a result of the wide range of theoretical approaches, there are several different assessments of academic success, including traditional measures and nontraditional measures. Even though the use of nontraditional measures is a valuable complement to the traditional measures of academic success, there is a lack of sound, comprehensive instrumentation.

The Academic Success Inventory for College Students (ASICS; Prevatt et al., 2011) is a newly designed assessment of academic success. The ASICS is a comprehensive, 50-item survey that is based on notable theories of academic success. Research on the ASICS has demonstrated sound psychometric properties (Prevatt et al., 2011). The ten factor structure and evidence of construct validity have been established through empirical investigation (Prevatt, et al. 2011; Welles, 2010). However, as the measure is in its early stages of development, additional validation of the ASICS was warranted.

The aim of this study was to further validate the Academic Success Inventory for College Students (ASICS; Prevatt et al, 2011). An Item Response Theory (IRT) analysis was used to help identify the strengths of the inventory as well as provide insights into how to refine its psychometric properties. Specifically, the study used a Logistic Graded Response Model, which is a unidimensional IRT analysis, on each of the ASIC subscales. The present study evaluated each item's fit, endorsement, and discrepancy.

Based on Logistic Graded Response Model results, none of the items fit the expected or hypothesized model. There are many potential reasons for the lack of item fit, such as limitations with the program software, issues with the data, poor item construction, and not using the most appropriate IRT analysis for the inventory. However, previous research has shown the ASICS to be a sound instrument; therefore, issues with programming is the most likely cause for the poor item fit. Many of the items had appropriate item endorsement and discrimination. This means these items were able to appropriately discriminate between varying levels of the subscale traits.
and participants did not tend to under-endorse or over-endorse the items. However, some of the items had inadequate endorsement and/or discrimination.

The results of the Logistic Graded Response Model analysis gave insight into the details of hypothesized constructs measured by the ASICS. General academic skills include keeping a good study schedule, working hard to understand the material, using of planners and organizers, setting specific homework goals, etc. Students who are internally motivated are confident in their skills/abilities. Students are motivated by future oriented factors, such as having career goals and understanding that the material they are learning in class can help them in the future. IRT analysis showed that assessing students about specific drinking behaviors does not detect differences in the socializing trait. In addition, internal motivation is not represented by enjoying the challenge of learning, most students were worried a lot about failing their most difficult class, and students needed a good grade to keep up their GPA.

Overall, based on the present study results, questionable ASICS items should be refined to strengthen the inventory's psychometric properties. Once software is available, the ASICS items should be evaluated according to a multidimensional IRT analysis to get a more accurate understanding of the item's psychometric properties. Finally, the ASICS continues to have strong psychometric properties and is a sound measure of academic success. Many universities and colleges would benefit from utilizing the ASICS to help increase the academic performance and graduation rates of their students.
APPENDIX A

Human Subjects Approval

Office of the Vice President For Research Human Subjects Committee Tallahassee, Florida 32306-2742
(850) 644-8673 · FAX (850) 644-4392

APPROVAL MEMORANDUM

Date: 8/2/2011

To: Desaree Dreher

Dept.: EDUCATIONAL PSYCHOLOGY AND LEARNING SYSTEMS

From: Thomas L. Jacobson, Chair

Re: Use of Human Subjects in Research
The Academic Success Inventory for College Students: An Item Response Theory Analysis

The application 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 one member of the Human Subjects Committee. Your project is determined to be Expedited per per 45 CFR § 46.110(7) and has been approved by an expedited 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 you submitted a proposed consent form with your application, the approved stamped consent form is attached to this approval notice. Only the stamped version of the consent form may be used in recruiting research subjects.

If the project has not been completed by 7/26/2012 you must request a renewal of approval for continuation of the project. As a courtesy, a renewal notice will be sent to you prior to your expiration date; however, it is your responsibility as the Principal Investigator to timely request renewal of your approval from the Committee.

You are advised that any change in protocol for this project must be reviewed and approved by the Committee prior to implementation of the proposed change in the protocol. A protocol change/amendment form is required to be submitted for approval by the Committee. In addition, federal regulations require that the Principal Investigator promptly report, in writing any unanticipated problems or adverse events involving risks to research subjects or others.

By copy of this memorandum, the Chair 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 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 Human Research Protection. The Assurance Number is FWA00000168/IRB number IRB00000446.

Cc: Frances Prevatt, Advisor
HSC No. 2011.6658
APPENDIX B

ASICS Item Category Curves

General Academic Skills Subscale Item Category Curves

Item 6

“I studied the correct material when preparing for tests in this class”

\[ \alpha = 0.496 \lambda = -1.86894 M = 5.40 \]

Item 10

“I worked hard to prove I could get a good grade”

\[ \alpha = 1.136 \lambda = -0.33800 M = 4.52 \]
Item 14

“I tried everything I could to do well in this class”

\[ \alpha = 1.569 \quad \lambda = -0.23401 \quad M = 4.46 \]

Item 16

“I worked really hard in this class”

\[ \alpha = 1.743 \quad \lambda = -0.37947 \quad M = 4.67 \]
Item 28

“I kept on a good study schedule in this class”

\[ \alpha = 1.633 \quad \lambda = 0.2675 \quad M = 3.65 \]

Item 36

“I worked hard in this class because I wanted to understand the material”

\[ \alpha = 1.030 \quad \lambda = -0.27296 \quad M = 4.38 \]
Item 39

“I studied a lot for this class”

\[ \alpha = 1.570 \quad \lambda = -0.31335 \quad M = 4.56 \]

Item 41

“I think I used good study skills when working in this class”

\[ \alpha = 1.598 \quad \lambda = 0.00099 \quad M = 4.08 \]
Item 55

“I made good use of tools such as planners, calendars and organizers in this class”

\[ \alpha = 1.007 \quad \lambda = 0.04140 \quad M = 3.98 \]

Item 56

“I used a goal setting as a strategy in this class”

\[ \alpha = 1.211 \quad \lambda = 0.37918 \quad M = 3.47 \]

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Item 57

“I was good at setting specific homework goals”

\[ \alpha = 1.282 \quad \lambda = 0.28155 \quad M = 3.65 \]

Item 58

“I was well organized”

\[ \alpha = 1.296 \quad \lambda = -0.08453 \quad M = 4.23 \]
Internal Motivation Subscale Item Category Curves

Item 8

“I got satisfaction from learning new material in this class”

\[ \alpha = 0.447 \quad \lambda = -0.11453 \quad M = 4.12 \]

Item 11

“I enjoyed the challenge of just learning for learning’s sake in this class”

\[ \alpha = 0.543 \quad \lambda = 0.50349 \quad M = 3.55 \]
Item 12

“I felt confident I could understand even the most difficult material in this class”

\[ \alpha = 0.752 \quad \lambda = 0.16380 \quad M = 3.85 \]

Item 13

“I was pretty sure I could make an A or B in this class”

\[ \alpha = 1.169 \quad \lambda = -0.21288 \quad M = 4.35 \]
Item 22

“I knew that if I worked hard, I could do well in this class”

\[ \alpha = 0.573 \quad \lambda = -1.41498 \quad M = 5.23 \]

Item 24

“I worried a lot about failing this class”

\[ \alpha = 0.534 \quad \lambda = 0.55578 \quad M = 3.40 \]
Item 34

“I was pretty sure I would get a good grade in this class”

\[ \alpha = 4.828 \quad \lambda = -0.10924 \quad M = 4.22 \]

Item 35

“I felt pretty confident in my skills and abilities in this class”

\[ \alpha = 5.578 \quad \lambda = -0.08450 \quad M = 4.17 \]
Perceived Instructor Efficacy Subscale Item Category Curves

Item 26

“I was disappointed with the quality of the teaching”

![Item Characteristic Curve: 0001](image)

$\alpha = 2.915 \quad \lambda = -0.09262 \quad M = 4.25$

Item 29

“I did poorly because the instructor was not effective”

![Item Characteristic Curve: 0002](image)

$\alpha = 2.931 \quad \lambda = -0.16442 \quad M = 4.37$
Item 33

“I would have done better if my instructor were better”

\[ \alpha = 2.068 \quad \lambda = -0.13173 \quad M = 4.28 \]

Item 42

“The instructor in this class really motivated me to do well”

\[ \alpha = 1.008 \quad \lambda = 0.46652 \quad M = 3.46 \]
Item 44

“Anything I learned, I learned on my own. The instructor in this class was not a good teacher”

\[ \alpha = 1.507 \quad \lambda = 0.50954 \quad M = 4.64 \]

*Concentration Subscale Item Category Curves*

Item 04

“It was easy to keep my mind from wandering in this class”

\[ \alpha = 1.457 \quad \lambda = 0.50954 \quad M = 3.11 \]
Item 07

“I had an easy time concentrating in this class”

\[ \alpha = 1.806 \quad \lambda = 0.40166 \quad M = 3.28 \]

Item 19

“I had a hard time concentrating in this class”

\[ \alpha = 1.505 \quad \lambda = 0.37899 \quad M = 3.35 \]
Item 25

“I got easily distracted in this class”

$\alpha = 1.659 \quad \lambda = 0.25770 \quad M = 3.51$

**External Motivation/Future Subscale Item Category Curves**

Item 9

“I needed to do well in this class to get a good job later on”

$\alpha = 1.210 \quad \lambda = 0.0619 \quad M = 3.89$
Item 23

“This class will be very useful to me in my career”

\[ \alpha = 2.404 \quad \lambda = 0.13885 \quad M = 3.68 \]

Item 46

“This class is important to my future success”

\[ \alpha = 2.039 \quad \lambda = 0.00543 \quad M = 3.99 \]
Item 51

“I think in the future I will really use the material I learned in this class”

\[ \alpha = 1.436 \quad \lambda = 0.04388 \quad M = 3.91 \]

Socializing Subscale Item Category Curves

Item 15

“Sometimes I partied when I should have been studying”

\[ \alpha = 1.324 \quad \lambda = -0.25903 \quad M = 4.54 \]
Item 20

“My grades suffered because of my active social life”

\[ \alpha = 1.803 \quad \lambda = -0.44868 \quad M = 4.93 \]

Item 45

“I got behind in this class because I spent too much time partying or hanging out with my friends”

\[ \alpha = 2.344 \quad \lambda = -0.62770 \quad M = 5.31 \]
Item 54

“Sometimes my drinking behavior interfered with my studying”

\[ \alpha = 0.470 \quad \lambda = -0.62750 \quad M = 4.58 \]

Career Decidedness Subscale Item Category Curves

Item 59

“I am certain about what occupation I want after I graduate”

\[ \alpha = 3.444 \quad \lambda = -0.26684 \quad M = 4.77 \]
Item 60

“I know what I want to do after I graduate”

\[ \alpha = 3.731 \quad \lambda = -0.3396 \quad M = 4.92 \]

Item 61

“I am having a hard time choosing a major”

\[ \alpha = 0.886 \quad \lambda = -1.11037 \quad M = 5.58 \]
Item 62

“I am certain that my major is a good fit for me”

$\alpha = 0.044 \quad \lambda = 0.39286 \quad M = 5.26$

Lack of Anxiety Subscale Item Category Curves

Item 5

“I was nervous for tests even when I was well prepared”

$\alpha = 0.635 \quad \lambda = 1.12546 \quad M = 2.90$
Item 18

“Studying for this class made me anxious”

\[ \alpha = 1.603 \quad \lambda = 0.3466 \quad M = 3.46 \]

Item 37

“I got anxious when taking tests in this class”

\[ \alpha = 0.939 \quad \lambda = 0.81133 \quad M = 3.04 \]
Personal Adjustment Subscale Item Category Curves

Item 2

“Personal problems kept me from doing well in this class”

\[ \alpha = 0.101 \quad \lambda = 1.65121 \quad M = 3.63 \]

Item 30

“I would have done much better in this class if I didn’t have to deal with other problems in my life”

\[ \alpha = 2.124 \quad \lambda = -0.17608 \quad M = 4.33 \]
Item 50

“I had some personal difficulties that affected my performance in this class”

\[ \alpha = 2.182 \quad \lambda = -0.18332 \quad M = 4.32 \]

*External Motivation/Current Subscale Item Category Curves*

Item 31

“It was important to get a good grade in this class for external reasons (my parents, a scholarship, university regulations)”

\[ \alpha = 0.093 \quad \lambda = 0.37083 \quad M = 5.35 \]
Item 32

“I worked hard in this class because I wanted others to think I was smart”

\[
\alpha = 0.585 \quad \lambda = 0.63755 \quad M = 3.49
\]

Item 49

“I needed good grades in this class to keep up my GPA”

\[
\alpha = 0.469 \quad \lambda = -2.68461 \quad M = 5.96
\]
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**BIOGRAPHICAL SKETCH**

Desaree Valerie Festa-Dreher was born and raised in New Jersey and is a proud member of her Italian family. Her sport participation, life experiences, and supportive family environment led her to pursue a Psychology degree with a minor in sport and coaching at Eastern University located in Pennsylvania. Desaree continued her higher education at Florida State University through her master's degree in Sport Psychology where she was able to work with many talented intercollegiate athletes. Desaree pursued her longstanding dream of becoming a psychologist and earning her Ph.D. by entering the Combined Program in Counseling Psychology and School Psychology at Florida State University. She completed her Ph.D. training by interning at The College of William & Mary Counseling Center where she was able to work with students and athletes.