PREDICTORS OF UNDERGRADUATE ACADEMIC SUCCESS

by

Sheri L. Glick-Cuenot

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Sheri Glick-Cuenot

This dissertation was prepared under the direction of the candidate's dissertation advisor, Dr. John R. Pisapia, Department of Educational Leadership, and has been approved by the members of her supervisory committee. It was submitted to the faculty of the College of Education and was accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

SUPERVISORY COMMITTEE:

John R. Pisapia, Ed.D.
Dissertation Chair

John D. Morris, Ph.D.

Dianne Wright, Ph.D.

Eleni Coukos Elder, Ed.D.

Robert Shockley, Ph.D.
Chair, Department of Educational Leadership & Research Methodology

Valerie Bristor, Ph.D.
Dean, College of Education

Deborah L. Floyd, Ed.D.
Interim Dean, Graduate College

11/10/2019
Date
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To Aunt Kelly, thank you for always being interested in what I was working on - now get out there, you can do it too!

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ABSTRACT

Author: Sheri Glick-Cuenot
Title: Predictors of Undergraduate Student Academic Success
Institution: Florida Atlantic University
Dissertation Advisor: Dr. John R. Pisapia
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This study attempted the answer to two primary questions: (a) Are strategic thinking skills possessed by college students prior to university matriculation related to their academic success in college, and (b) How does the predictive accuracy afforded by these skills compare to that from high school grade point average or standardized test scores?

A non-experimental quantitative longitudinal research design was employed to conduct this analysis. Three cognitive skills associated with strategic thinking (reframing, reflection, and systems thinking) high school grade point average and standardized test scores served as predictor variables. Six contextual variables – age, gender, ethnicity, education of mother, education of father and academic discipline served as moderators of the relationship between the use of strategic thinking skills and student academic success. Predictor and moderator variable data were collected in the fall of 2009 from a random sample of 229 entering freshman in their first three weeks of university matriculation to mitigate
the effect of their program of study and college experience on their thinking skills.

The criterion variable - academic success – was measured by student college grade point average, time to degree and degree earned. Data on the criterion variable were collected during the summer of 2013 and fall 2014, from university archival sources, for academic years 2009-10, 2010-11, 2011-12, and 2012-13. Multiple regression and correlation analyses were used to test the hypotheses engendered by the research questions.

This research found significant positive correlations among the use of strategic thinking skills and high school grade point average, college grade point average, time to degree and degree earned. College grade point average was the strongest predictor of time to degree and degree earned. These findings add a new dimension that colleges and universities may wish to consider in their admission decisions. The findings also suggest that curricula in K-12 education should be examined to be sure these skills – reframing, systems thinking, and reflecting are taught and learned. Thus, the findings will have theoretical and practical significance.
DEDICATION

I would like to dedicate this work to my family. To my parents, Fran and Harvey Glick, finally a doctor in the family, and Dad, sorry I never became an attorney - I hope this is okay too! To my brothers, Robert and Michael, thanks for teaching me to be tough and always looking out for me.

To my husband Kevin, I could never have done this without your love and support. Thank you for giving me the time and space to achieve this goal. I promise I’ll get a job!

To my daughters, Sophia, Samantha and Skylar: I hope this accomplishment guides you to achieve whatever your dreams are in the future. No matter how long it takes, never give up, never give in, surround yourself with positivity and love and always believe in yourself.

To Dr. Judith Pullen-Boyle: without your guidance I may have never gotten to this point. Your words have stuck with me throughout the years. I thought of them often and they became my mantra: “If it was easy, everyone would do it”.

Finally, to the thousands of students out there who are brilliantly smart and are beyond capable of college level work (but may not test well). You have tremendous skills and abilities. Don’t ever allow your scores to define you; don’t ever allow anyone tell you you can’t succeed or stand in the way of your success!
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CHAPTER I.
INTRODUCTION

A world-class education is the single most important factor in determining not just whether our kids can compete for the best jobs but whether America can out-compete countries around the world. America's business leaders understand that when it comes to education, we need to up our game. That's why we're working together to put an outstanding education within reach for every child.

President Barack Obama, July 18, 2011

Robert Sternberg (2010) argues that one of the most pervasive problems facing universities today, in admissions, as well as in instruction, is that many individuals within the institution are “locked into an archaic notion of what it means to be intelligent” and have wasted much in the way of “human resources as well as the mis-education of millions of youngsters” (Sternberg, 2010, p.71). By understanding new ways of thinking which, in turn, can create academic success, institutions can begin to adapt their policies and procedures to admit students with greater capacity for academic success as well as for citizenry.

This issue has also been a target of public policy. For instance, in 2011 the Obama administration pointed the federal spotlight on increasing the number of college-educated citizens as our nation’s first line of offense in maintaining America’s advantage in the world economy. America cannot afford to lose one mind in its struggle to maintain its competitive edge. Therefore, President Obama declared that every American student
beyond K-12 should have at least one year of formal higher education or job training to keep our nation economically competitive. This focus puts a premium on understanding what makes students successful in academics vital, not just for the students themselves, but for the universities, which hope to retain them and a nation that needs their skills to remain a force in the global marketplace.

Both the Nation’s K-12 system and institutions of higher education have roles to play in developing the intellectual capital of their students. Educators and employers have long recognized that cognitive abilities and the ability to think critically are among the most important real life outcomes and advantages of a college education (Halpern, 1998; Jones et al., 1995; Schmitt et al., 2009; Stupinsky, Renaud, Daniels, Haynes, & Perry, 2008). What role then, does this “ability” to possess intellectual capital have on academic achievement and other measures of success in college? This fundamental question requires colleges and universities to reflect in the ever-changing and competitive marketplace of the student as consumer.

**Background of the Study**

Scholars have debated which measures best predict student academic success in higher education; from this debate four streams of research have emerged. One research stream argues that a student’s ability to be successful is best predicted by his/her high school grade point average (HSGPA), (Atkinson & Geiser, 2009; DeBerard, Speilmans, & Julka, 2004; Geiser & Santelices, 2007; Geiser & Studley, 2004; Hall, 2001; Hall, Smith, & Chia, 2008; Lotkowski, Robbins, & Noeth, 2004; Stupinsky et al., 2007). A second stream of research suggests that standardized test scores, such as the Scholastic Assessment Test (SAT) and the American College Test (ACT) are the best predictors of a
student’s ability to be successful in college (Astin, 1993; Schmitt, et al., 2009; Sparkman, Maulding, & Roberts, 2012; Sternberg, 2010). And yet another stream of research suggests that a student’s ability to think is the best predictor of success (APA, 1993, 1997 as cited in Zins, Weissberg, Wang, & Walberg, 2004; Stupinsky, et al., 2008). Finally, a fourth stream of research claims that alternative measures, such as creativity, motivation, persistence, academic goals, emotional intelligence and other non-cognitive measures are viable predictors of student academic success (Astin, 1993; Beck & Davidson, 2001; DeBerard et al., 2004; Parker & Duffy, 2005; Parker, Duffy, Wood, Bond, & Hogan, 2005; Sparkman et al., 2012).

Even though each of these areas of research, all of which are based on empirical studies, are viable options and measurements for college admissions, the ability to predict college success beyond the freshman year is reported to be limited within the literature (Harackiewicz, Barron, Tauer, & Elliot, 2002). Through a longitudinal study, this current research addresses the gap in the literature by focusing on academic success beyond the freshman year toward the attainment of an undergraduate degree.

**Purpose of the Study**

The purpose of this study was to determine how thinking skills used by college students prior to university matriculation, high school grade point average (HSGPA), and standardized test scores (SAT) are related to their college grade point average (CGPA), Time to Degree, and Degree Earned. Specifically, this study sought to answer two important questions: (a) what strategic thinking skills (STS) do college students possess prior to university matriculation and (b) how do the students’ use of these skills compare to HSGPA and standardized testing
scores in predicting academic success? The following three sub-questions guided the study’s research design, data collection, and data analysis:

1. What strategic thinking skills (STS) do entering freshman possess?
2. What is the relative contribution of each predictor variable to predicting academic success variables?
3. Are these relationships moderated by contextual factors?

**Significance of the Study**

The significance of this research exists on several levels. First, the results of this study may be used as a means to forecast factors that most effectively predict entering freshman student academic success. Many states, including, Florida, Tennessee, Pennsylvania, Arizona, Maine, Ohio, Michigan and others are moving to a funding model based on outcomes rather than enrollment, in both two-year and four-year academic institutions. After a half a century of research on tools used to determine the academic success of students entering college or university, much of the research still does not go outside predicting success in college beyond the freshman year. This longitudinal study begins to fill in this gap in the literature. Second, the relationship between student success and strategic thinking skills has implications for secondary and postsecondary education, practitioners, administrators, researchers, and most importantly students. For secondary education, the curriculum and teaching methods, which have become more scripted, can be tweaked to maximize student performance. The knowledge gained from the study could lead to ongoing efforts of theorists and practitioners who seek to uncover methods for identifying early academic interventions in order to maximize students’ potential for learning. For colleges and universities, university administrators, and curriculum
designers, the results would hopefully influence admissions decisions, remedial programs, and the core curriculum.

The results will provide better data regarding predictions of performance, persistence, and completion, which go beyond current data. Finally, the findings from this study will be critical and highly beneficial for students. Command of these strategic skills will equip students with the intellectual tools needed to make sense of complexities facing them during their immersion into university life. Thus, students will be able to identify, predict, respond and adapt to non-linear change opportunities and challenges—arming them as they progress toward their degrees and pursue their careers. Furthermore, this study has foundational meaning by which further research can be conducted, specifically, reframing, reflection and systems thinking—the three cognitive leadership skills comprising strategic thinking, and how each may be used in different types of higher educational settings and degree programs.

**Theoretical Framework**

This study focuses on the exploration of factors which best predict student academic success in higher education. Among the central concepts framing this study are: (a) high school grade point average, (b) standardized testing, (c) cognition, (d) contextual factors, and (e) academic success. Figure 1 introduces the theoretical framework guiding this research study. This framework suggests the relationships among these concepts and that student ability is expressed through, high school grade point average, standardized testing, and cognition. It further assumes that some combination of these factors, in addition to various contextual variables, contributes to higher levels of student academic
success (i.e., college GPA, time to degree and degree earned). Each of these constructs is described in detail in the sections that follow.

**Figure 1.** Theoretical Framework for Predicting Undergraduate Academic Success.

**Predictor Variables**

**High School Grade Point Average**

High school grade point average has been shown to be the single best predictor of college success (Geiser, 2007; Geiser (with Studley), 2002; Harris, 1940; Sparkman et al., 2012). Admissions counselors and other university officials review past performance such as HSGPA, as an indication of future performance. Repeated academic performance over a period of time gives insight into a student’s ability to be successful in a particular course of study. HSGPA is not only valuable in predicting first year college success but is a greater predictor of academic success in terms of predicting grades in subsequent years as well (Geiser, 2007; Geiser (with Studley), 2002; Kowarsky, Claftelder, & Widaman, 1998). Geiser, (2007) asserts that the “predictive weight associated with HSGPA increases after the freshman year, accounting for a greater proportion of the
variance in cumulative fourth-year than first-year college grades” (p. 1). Since HSGPA has been shown throughout decades of research (Atkinson, 2001; Geiser, 2007; Geiser (with Studley), 2002; Kowarsky et al., 1998; Schmitt et al., 2009; Sternberg, 2010) to be one of the best predictors of not only freshman year success and subsequent semesters (Harris, 1940), but also further down the line to degree attainment, it is consistently used in research.

High school grade point average (HSGPA) is the most widely used predictor of academic success in higher education (Atkinson & Geiser, 2009; Boon, 2001; Geiser & Santelices, 2007; Geiser & Studley, 2004; Hall, 2001; Hall et al., 2008; Harris, 1940; Nisbet, Rubel, & Schurr, 1982; Noble, 1989, 1991 as cited in Thomas, Kuncel, & Crede, 2007; Sternberg, 2010; Stupinsky et al., 2007; Zins et al., 2004). HSGPA is also the most frequently used moderator variable in research on the SAT (Camara & Echternacht, 2000; Geiser (with Studley), 2002) and other standardized testing measures such as the ACT.

HSGPA is the most extensively used predictor variable, because it is convenient to collect, and is based on previous achievement. HSGPA is a reflection or snapshot of a student’s previous achievements and mastery of skills and knowledge base; therefore it is usually the cornerstone to any research on academic achievement (Harris, 1940; Sternberg, 2010). Atkinson (2001) suggested that HSGPA and even the SAT- II subject area tests, which represent past and repeated academic performance for perspective candidates should be given more weight than the less reliable SAT-I. Although there have been hundreds, perhaps even thousands of predictive validity studies, which purport the
use and reliability of HSGPA as the best predictive measure of college performance, its use has its share of detractors.

Critics, including the Moore’s 2003 Report suggested that HSGPA is not a reliable measure on its own because there is no national standard for course grades. Critics also point to issues of grade inflation as a reason why HSGPA may not be reliable. But perhaps the most obvious concern is over how this transformation, in weighting HSGPA or another measure more and disregarding or giving less credit to standardized test scores will alter the ranking of schools in the *US News and World Report* and other publications. The general public looks to these and other resources such as *Barron’s Profiles on American Colleges* for insight on how the schools are ranked nationally (Epstein, 2009; Geiser, 2007) without the use of the SAT/ACT, these rankings may not be deemed valid.

**Standardized Testing**

In an effort to achieve a “comprehensive system” of American higher education, it was the Carnegie Foundation that had the greatest single impact on the standardization of the University system (Rudolph & Thelin, 1990, p. 432). This includes the standardization of admissions and testing and in 1908 the Carnegie Foundation put major emphasis on defining a unit of admissions credit. Early on in our nation’s history, the ability to go to college rested on three factors: (1) male, (2) white, and (3) wealthy. It was these three factors that determined whether or not a student was admitted into college and not necessarily their ability to be successful.

Obviously these three requirements are no longer the standard for obtaining a college degree. Anyone with a desire to learn can apply to the college or university of
their choice. There are no laws or acts of congress that can deter a student from obtaining a college education. There is however, a roadblock for many students when it comes to the admissions criteria. Standardized testing including the most famous, SAT and ACT, are both such roadblocks. Many high achieving students who have mastered course work throughout their high school years encounter difficulty when sitting for the SAT/ACT. Students experiencing this hurdle find getting accepted to college more difficult than the college level work itself, leaving many frustrated and discouraged with the admissions process.

Concerns about the SAT specifically, date back to the 1940’s. Many critics, especially those within the academic community, suggested that from the beginning, these standardized tests amounted to nothing more than a “multiple choice version of an IQ test” (Atkinson, 2005 p. 15). Atkinson (2005), who discusses a personal perspective on the SAT and admissions decisions, suggested that, “achievement tests are designed to measure mastery of a specific subject. In contrast, aptitude tests are designed to predict an individual’s ability to profit from a particular type of training or instruction” (Atkinson, 2005 p. 15).

Atkinson and Geiser (2009), two of the most renowned researchers on standardized testing and academic success, assert that admissions counselors in our colleges and universities should move more toward “curriculum based achievement tests” rather than standardized tests such as the SAT and ACT (as cited in Linn, 1989, p. 677; National Association for College Admissions Counseling [NACAC], 2008). In fact, Atkinson, (2001) as the President of the University of California state system, in an address to the American Council on Education stated: “I recommend that the University
require only standardized tests that assess mastery of specific subject areas rather than undefined notions of ‘aptitude’ or ‘intelligence’ (Geiser (with Studley), 2002, p. 2). This seminal address to the Board of Admissions and Relations with Schools (BOARS) was quite influential as it once again spurred the national debate over the validity and use of standardized tests within the American college system (Geiser (with Studley), 2002).

All of this is not to say that standardized testing does not have a role to play within the admissions process. Its predicative validity cannot and should not be ignored by those on either side of the argument for alternative testing. The feeling is that perhaps, mitigating some of the weight these scores carry in the admissions process should be considered. As should discovering what other measures may make a student not only successful in academics during their college years, but what will eventually deem them successful as citizens of the world.

**Cognition and the Strategic Thinking Framework**

Cognition deals with the nature of knowledge itself and how humans eventually develop the ability to cultivate, construct, and use it. Put simply, cognition is the way an individual thinks and how those thoughts transform into behaviors and behaviors into actions. The degree to which a person possesses a wide array of thinking schema, scripts, and structures refers to their cognitive complexity. The degree to which a person uses a wide array of thinking skills refers to their cognitive behavioral agility.

Cognition is the way thinking is done. Mental or cognitive skills enable individuals to acquire knowledge by manipulating ideas and processing new information and beliefs in their minds. Information, memory, reasoning, application of schemas and biases, making attributions and thinking-through a problem are examples of cognitive
processes. The cognitive process considers how ideas, thoughts and mental representations develop and are used by individuals to make a mental connection, between seemingly disparate events. Furthermore, it affects change in beliefs, values and direction (Gardner, 1995; Senge, 1990). The mental connections enabled by these skills form the foundation for enhanced performance as well as continuous learning.

Many important cognitive processes have been identified in the literature such as: chunking (Agor, 1988; Newell & Rosenbloom, 1981; Simon, 1957, 1999), cognitive reduction (Simon, 1957), cognitive heuristics (Stanwick, 1996), cognitive maps/schemas (March & Simon, 1958; Simon, 1957; Stanwick, 1996), mental imagery (Anthony, Bennet, Maddox, & Wheatley, 1993; Stanwick, 1996), creativity (De Pree, 1989), mental models and schemas (Senge, 1990; Riedel, Morath, & McGonigle, 2000; Weick, 1995), critical thinking (Baron, 1994; Cohen et al., 2000; Halpern, 1996; Riedel, et al., 2000), pattern recognition (Cohen et al., 2000; Simon, 1957, 1999), reframing (Bolman & Deal, 1994; Morgan, 1987), reflection (Argyris & Schön, 1978; Dewey, 1933; Schön, 1983), and systems thinking (Senge, 1990). However, some have argued that there may be too many strategies for the decision maker to remember, consider, select, and apply (Perkins, 1995).

Furthermore, there are many modes of thinking that individuals can use. For example, critical thinking is often cited in the literature as an essential component of academic achievement; however, higher education has not lived up to the task of imparting this skill on its students in a consistent manner (Flores, Matkin, Burbach, Quinn, & Harding, 2012). Ennis (1962) foundational definition was “critical thinking is taken to be the correct assessing of statements” (p. 83). Forty-two years later Stupinsky et
al., (2008) suggests a broad definition of critical thinking as “a set of cognitive skills, such as identifying central issues and assumptions, evaluating evidence, and deducing conclusions” (p. 514). While many definitions have been offered within the forty two years of these statements it is rather clear that identifying issues, assessing the assumptions from available evidence and drawing inferences, is at the heart of critical thinking. There is good reason to accept critical thinking as a fundamental and foundational piece of a college education, but it is not enough to be successful in the modern world (Sternberg, 2010).

Over the last several decades, the need for students and workers to think critically, to decipher information quickly and rise to immediate challenges, has led to the need for embracing different forms of intellectual capital. Critical thinking, as defined by Ennis (1962) and Stupinsky et al., (2008) is necessary but other forms such as synthetic and creative thinking, which is the ability to move from abstract thought into concrete ideas and actions, are becoming just as important. In today’s world and into the future, the availability of vast amounts of easily attained knowledge as well as the ability to use this knowledge in one’s decision making and problem solving processes requires an ability to retrieve, absorb and use information in a more rapid and integrated fashion (Flores et al., 2012). Thus, synthetic and creative thinking are now seen as complementary and as necessary as critical thinking skills in order to make sound judgments, identify innovative solutions, and for transforming oneself and their organizations. Yet, information regarding these factors which may contribute to student’s capacity to possess and develop the ability to think in a critical, synthetic, and creative manner and the implications of that knowledge on academic success is scarce (Stupinsky et al., 2008).
For students in today’s schools, colleges and universities, the concept of synthetic and creative thinking are not completely new; just under-used even though they could be critical to their eventual academic success (Boon, 2001; Zins et al., 2004). This point was emphasized in an American Psychological Association (APA) report, which suggested that “The successful learner can create and use a repertoire of thinking and reasoning strategies to achieve complex learning goals” (APA, 1993, 1997 as cited in Zins et al., 2004, pp. 29-30).

The literature is replete with knowledge and indicators of cognitive capability. The research is less clear on definition and measurement of such indicators. There is a paucity of instrumentation measuring the development of students’ mindset. Although there are a number of tests available that look at aspects of strategic thinking (e.g. creativity) (Hocevar & Bachelor, 1989), and divergent thinking (Torrance, 1974), there is an evident need for more comprehensive testing measures of critical thinking skills (College Board, 2009). Such research could lead to the identification of selection criteria which best predict long-term strategic thinking ability and eventually perhaps, academic success.

Drawing on the theoretical literature, (Argyris & Schön, 1978; Baron, 1994; Bolman & Deal, 2003, 2008; Capra, 2002; Chilcoat, 1995; Cohen et al., 2000; Dewey, 1933; Halpren, 1996; Kets de Vries, 2001; Leithwood & Steinback, 1992; Lord, de Vader, & Alliger, 1986; March & Simon, 1958; Marcy & Mumford, 2010; Morgan, 1987; Mumford & Connelly, 1991; Mumford, Connelly, & Gaddis, 2003; Mumford, Zaccaro, Harding, Jacobs, & Fleishman,
2000; Schön, 1983; Senge, 1990; Simon 1999; Weick, 1995), Pisapia, Reyes-Guerra, and Coukos-Semmel (2005) began to fill this need for measures to test for integrative and divergent thinking by identifying three cognitive skills – reframing, reflecting and systems thinking, depicted in Table 1.

Based on their review of the literature, they assumed these skills would enable leaders to recognize patterns, interdependencies, and make consequential decisions as well as help individuals make sense of complexities and enable them to identify, predict, respond and adapt to non-linear change opportunities and challenges, allowing them to be more successful in preparation programs and career roles. They hypothesized that strategic thinking might differentiate between more successful and less successful individuals and set out a framework to measure the use of the three skills by individuals.
Table 1

**Description of Strategic Thinking Skills**

<table>
<thead>
<tr>
<th>Strategic Thinking Skills</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Systems Thinking</td>
<td>Systems thinking refers to the leader’s ability to see systems holistically by understanding the properties, forces, patterns and interrelationships that shape the behavior of the system, which hence provides options for action.</td>
</tr>
<tr>
<td>Reflecting</td>
<td>Reflecting refers to the leader’s ability to weave logical and rational thinking, through the use of perceptions, experience and information, to make judgments on what has happened, and creation of intuitive principles that guide future actions.</td>
</tr>
<tr>
<td>Reframing</td>
<td>Reframing refers to the leader’s ability to switch attention across multiple perspectives, frames, mental models, and paradigms to generate new insights and options for actions.</td>
</tr>
</tbody>
</table>


In the ten years since their article appeared, the constructs have remained consistent; however, test items that comprise their original instrument have undergone several iterations. These iterations have been used to study leaders, managers, and supervisors of various types of organizations, including both for-profit and non-profit agencies as well as with graduate level students. In 2006, Pisapia, Reyes-Guerra, and Yasin, conducted a study of 136 leaders from different organizations, including profit (40%) and non-profit (60%) organizations. Among the major findings:

(a) systems thinking is significantly related to leader success, (b) the use of the three systems thinking skills in particular could distinguish between
more successful and less successful leaders, (c) while systems thinking explained most of the variance in the success variable, there was a cumulative impact in the use of all three skills, and, (d) USA participants demonstrated more strategic thinking capabilities than non-USA participants. (Pisapia et al., 2006, p. 22)

**Student Academic Success**

Student academic success serves as the criterion variable in this study. Unfortunately, “There is no one agreed upon measure of college success” (Camara & Echternacht, 2000, p.3). However, several measures have been used in a multitude of studies including: course grades (Atkinson, 2004, 2005; Atkinson & Geiser, 2009; Geiser & Santelices, 2007; Kendrick & Thomas, 1970; Merante, 1983; Zwick & Sklar, 2005), class rank (Baron & Norman, 1992; Perez, 2002), and retention (Astin, 1993; Bynum & Thompson, 1999, as cited in Thomas, Kuncel, & Crede, 2007; Tross, Harper, Osher, & Kneidinger, 2000) are a few. Freshman GPA’s (Camara & Echternacht, 2000; Tross et al., 2000; Wolfe & Johnson, 1995) and other individual student indicators such as motivation, academic discipline, emotional control, commitment (Borkowski, Carr, Rellinger, & Pressley, 1990; Borkowski, Chan, & Muthukrishna, 2000; Kaufman, Agars, & Lopez-Wagner, 2007; Robbins, Allen, Casillas, Peterson, & Le, 2006) and other non-cognitive variables have all been used in determining academic success of college students.

The plethora of information regarding academic success in college suggests that while HSGPA and standardized test scores provide some basis for predicting success, other cognitive and non-cognitive variables as well as other skills may also play an
important role in determining whether or not students will achieve academic success in college (Astin, 1993; Beck & Davidson, 2001; DeBerard et al., 2004; Parker & Duffy 2005; Parker et al., 2005; Sparkman et al., 2012). This study defines academic success as college grade point average, time to the completion of a degree and degree earned.

**College Grade Point Average**

When research into the academic success of students is focused on persistence and retention as well as on degree completion, (Schmitt, et al., 2009) one factor that comes up over and over again is college grade point average. Like HSGPA, the CGPA during the college years is a repeated measure on a sometimes diverse but often times more comparable set of courses. Indeed, in a review of the literature between 1930 and 1937, Harris (1940) argued that, “In addition to precollege-entrance criteria, first-semester or first-quarter grades have been found to be the best single criterion for prediction of later grades” (p.125).

The assumption is that as college and university students persist toward their degree attainment, especially during the last two years of college when, students have moved toward course work more specific to their major, there is increased likelihood of higher and more consistent grades from semester to semester. Harackiewicz et al. (2002), suggest that a longitudinal study in this area could offer “analysis of the short- and long-term effects of goals, relative to other potential predictors” (p. 563).

Although many studies use HSGPA as a predictor of short-term college success, it is the CGPA that shows long-term academic success, and the attainment of an undergraduate degree (Geiser, 2007). In a study conducted by Geiser (2007) based on 80,000 University of California undergraduate students on several different campuses, the
CGPA increased several points throughout the academic career of academically successful students who obtained undergraduate degrees within a four-year time frame. Currently, HSGPA is the most valuable tool in assessing academic success simply because it is a repeated measure of students’ performance over a period of time. The same can be said for the CGPA during the college years. Geiser (2007) suggests that:

cumulative college GPA, like HSGPA is based on repeated sampling of student performance over time in a variety of academic settings, CGPA in the fourth year of college tends to be less variable and possibly a more reliable indicator of students’ true ability and achievement than their first year grades (p.17).

Therefore, like HSGPA is a viewed as a reliable predictor of freshman year performance, CGPA is used as a measure of academic success and is used as one of the criterion variables for in this study.

Retention and Time to Degree

Many students, who leave college, do so within the first two years (Tinto, 1987). There is a great deal of research that suggests that academic success and retention go hand in hand (DeBerard et al., 2004). If a student completes one semester successfully, the chances of them enrolling for a second semester and working toward the completion of their degree is also a major determinant of academic success. Though retention is not just based on academic factors but non-academic factors as well (i.e., student life, personal finances, and campus climate) the fiscal effects of retention can be major from the standpoint of the University (Boon, 2001; Lotkowski et al., 2004; Sternberg, 2010; Stupinsky et al., 2007; Tross et al., 2000; Zins et al., 2004). Students who leave do not
pay tuition, buy books or pay for season tickets in order to attend football games. Lack of retention equals less funding for the institution and its auxiliary units.

For college administrators, retention (herein time to degree) is one of the most important pieces of the higher education puzzle. Retaining students so they achieve academic success and graduate is paramount to the mission of most, if not all colleges and universities (Lotkowski et al., 2004). Successfully retaining students’ semester after semester and year after year, until they reach graduation day and eventually turning one-time students into philanthropic alumni, can be integral to the long-term success of the institution (Lotkowski et al., 2004).

**Degree Earned**

Few higher education metrics have attracted as much controversy as the institutional graduation rate (Borkowski et al., 1990; Borkowski et al., 2000). Critics say it relies heavily on student characteristics and actions; advocates such as American Association of State Colleges and Universities (AASCU) maintain that it is a legitimate accountability indicator when combined with other measures. The National Center for Education Statistics (NCES) (2004), states, “today’s freshman may now spend in excess of six years…obtaining an undergraduate degree” (as cited in Hall et al., 2008, p. 1087). There is one thing that is commonly agreed upon however; there is growing emphasis placed on institutions of higher education to graduate students in a timely manner (Scott, Bailey, & Kinzel, 2006). This study adds three criterion variables for study; college grade point average, time to degree and degree earned and moves the conversation toward efficiency and learning outcomes.
As with retention data, the completion of a degree is probably the most universal measure associated with academic success (Camara & Echternacht, 2000; Lotowsky et al., 2004; Sternberg, 2010; Tross et al., 2000; Wolfe & Johnson, 1995). Many factors can contribute to a more extended time frame in earning an undergraduate degree. Factors including financial concerns, employment status, and indecision with regard to choosing a major, are all related to length of enrollment in a college or university (Hall et al., 2008; NCES, 2004). Additionally, the importance of degree completion has an impact on everything from the standards of living and labor market earnings to marriage and family decisions (Buchmann & DiPrete, 2006; DiPrete & Buchmann, 2006). Furthermore, the completion of a college degree remains an essential safeguard against poverty (Buchmann & DiPrete, 2006).

**Contextual Factors**

Several alterable and unalterable contextual factors which may influence the relationship between strategic thinking skills and academic success, were identified through a review of previous studies which suggests that age (Fischer & Bidell, 1998; King & Kitchner, 1994; Lynch & Wolcott, 2001; Wolcott & Lynch, 1997), gender (Buchmann & DiPrete, 2006; DiPrete & Buchmann, 2006), and ethnicity (Astin, Bayer, & Baruch, 1968 as cited in Thomas et al., 2007; Coleman, 1966 as cited in Thomas et al., 2007; Zwick & Sklar, 2005) are associated with student academic success in college. Research also points to personal data such as parental education level (Atkinson & Geiser, 2009; Blau & Duncan, 1967; Buchmann & DiPrete, 2006; Geiser, 2007; Jencks, 1972; Sewell, Haller, & Portes, 1969) and academic major (Reyes-Guerra, 2009) as having an effect on student academic performance. Age, gender and ethnicity are
considered unalterable variables since they cannot be adjusted. Parental education level and academic major are considered alterable variables since they can be changed.

The moderating assumption is whether the relationship between thinking constructs and academic success varies as a function of contextual variables. For example, older students, due to their experiences, may have a better strategic mindset than younger students. Additionally, exposure to parents who have greater levels of educational achievement may also have an effect on students’ level of strategic mindset (Dubow, Boxer, & Huesmann, 2009; Leppel, Williams, & Waldauer, 2001; Linn, 2009; Naumann, Bandalos, & Gutkin, 2003; NACAC, 2008; Spera, Wentzel, & Matto, 2009).

This study uses these contextual variables to determine what if any influence they have on the prediction of undergraduate academic success.

**Methods**

The study employed a quantitative longitudinal design. The study was conducted in three phases over a four-year time frame. First, by administering the Strategic Thinking Questionnaire (STQ), the strategic thinking skills of a cohort of 229 first semester freshman from various disciplines was assessed, during the first three weeks of matriculation in the fall of 2009. This time frame was specifically chosen as to mitigate the effect of students’ program of study as well as their college experiences on their performance. Using the university database, archival data on undergraduates were used to determine what students’ HSGPA, SAT/ACT scores, CGPA, academic major, time to degree and degree earned status was over the four-year time frame. This information was obtained during the summer of 2013 and fall 2014 semesters.
The Strategic Thinking Skills (STS), HSGPA and SAT/ACT scores were selected as the predictor variables. HSGPA and standardized testing measures are the most widely used instruments/tools to predict academic success, therefore they were chosen for this study to see how they compare to the predictability of STS skills. Academic success, the criterion variable, was measured through CGPA (for all subsequent semesters), time to the completion of a degree and the attainment of an undergraduate degree. These variables were chosen in order to gain insight into how study participants were fairing throughout their collegiate experience. The influence of participant demographics including, age, gender, ethnicity, parental educational level, and academic major were deemed the moderating variables to determine what if any impact they had on the relationship of the predictor variables and academic success.

Inferential statistical methods were used to analyze the data. These include descriptive statistics, multiple regression and correlational analyses.

Chapter Summary

This chapter described the problem, purpose, and significance of this study. It then described the basic constructs from which the hypotheses were drawn. It ended by describing the methods used to conduct the study. Chapter Two will elaborate on the review of literature upon which the theoretical framework is built.
CHAPTER II.

LITERATURE REVIEW

The literature on whether or not alternative measures for undergraduate academic success should be implemented within our colleges and universities is not always clear. Those within the higher education system, both academic and administrative are split between traditional methods such as standardized testing and more non-traditional methods such as utilizing a student’s ability to think and use their experiences to navigate their new world in order to achieve success. This study explores traditional and non-traditional methods of evaluating potential candidates for admissions on the basis of pending academic success. Additionally, this study provides a basis for which strategic thinking skills may be more accurate in determining the potential academic success for undergraduates.

Traditional Methods for Determining Undergraduate Academic Success

“In 1945, the Harvard Committee on General Education in a Free Society, published an address that asked the most ancient question: What ought an educated man know?” (Rudolph & Thelin, 1990, p. 474). This question has yet to be answered in any real or satisfactory way. In the 21st century, what should an educated man or woman know and how do colleges and universities go about bringing all of those with potential and the capacity, not just for academic greatness but for civic contributions as well, into the fold? How do institutions of higher learning create a system of assessment and
admissions that is both progressive and meaningful when trying to bring the best and brightest into their institutions? Since the nature of the times we find ourselves in today has changed, so has the nature of what it means to be educated and successful. Academic success can be defined in many different ways, however by most university standards, academic success is usually defined by grades and the ability to earn a degree within a timely fashion.

Admissions counselors are trained to look for students who will be academically successful based on traditional methods of academic achievement including and usually with the most emphasis on, high school grade point average (HSGPA) and standardized testing such as the Scholastic Assessment Test (SAT) and/or American College Test (ACT). Other factors that play into admissions decisions include faculty recommendations, extracurricular activities and community service projects. However, these additional requirements are institution specific and not measured uniformly; the weight given to these requirements is usually not the same as HSGPA and SAT/ACT. Furthermore, most accredited colleges and universities have one thing in common, their admissions packet almost always requires a student to provide HSGPA and a standardized test score from either the SAT or the ACT (Sternberg, 2010). The following paragraphs review the literature regarding the history of college admissions, the three predictor variables 1) HSGPA, 2) standardized testing scores and 3) Strategic Thinking Skills of the study and academic success variables including, college grade point average (CGPA), time to degree and degree earned.
High School Grade Point Average

The most widely accepted and most accurate tool colleges and universities have to determine whether or not students will be successful in college is the high school grade point average (Geiser, 2007; Geiser (with Studley), 2002; Geiser & Studley, 2004; Harris, 1940; Lotkowski et al., 2004; Sparkman et al., 2012; Sternberg, 2010). As this tool is readily available and easily accessible, the HSGPA provides institutions with a student’s strengths and weaknesses over the course of four years. HSGPA is not only useful for providing insight on students’ various academic inclinations but it also allows institutions the ability to appropriately place students according to their academic achievement level.

The best predictor of future performance is past performance (Geiser, 2007; Geiser (with Studley), 2002; Geiser & Studley, 2004; Harris, 1940; Lotkowski et al., 2004; Sparkman et al., 2012; Sternberg, 2010). The same is true for academics. The best predictor of college academic success is high school academic success (Sternberg, 2010). HSGPA signifies that students have either gained mastery over a subject or not. Students ability to learn and ultimately understand what is being taught, navigate through course work, examinations, teaching styles and subject matter are all reflected within the HSGPA (Sternberg, 2010). Therefore, it is much more than just a number or an accumulation of numbers and scores. The HSGPA is actually a detailed picture of how a student has progressed over a given period of time and either excelled or not and in which course work they have done it in. It speaks volumes about not just academic achievement, but students’ motivation and willingness to actively participate in their academic success.

Though most of the research clearly supports HSGPA as the single best predictor of college success (Atkinson, 2001; Atkinson & Geiser, 2009; Geiser & Studley, 2004;
Lotkowski et al., 2004; Perez, 2002; Sternberg, 2010; Zwick & Sklar, 2005), it too has its share of criticism. A major area of concern with HSGPA is that there is no standard national curriculum. Thus, there is no national standard by which HSGPA is calculated or grades assigned. It is up to each school or district to determine which grades carry what weight as well as which courses will be considered as counting towards HSGPA credits and which will not. Students in rural Alabama may not be measured in the same manner as a student in New York City. Their respective schools may not count the same courses towards receiving the same credits in their HSGPA. The question then becomes; is the A that one student earns as valuable as the A another student earns? This point seems subjective in nature (Sternberg, 2010). Though concern over “grade inflation” is a reasonable argument, there is at this juncture, no national movement toward the creation of a national standard or curriculum for K-12 education. Thus, these concerns are not likely to be addressed.

In 2008, the ACT released data showing that about two in ten eighth graders were on target to be college-ready by the time they completed high school. Therefore, the National Governors Association Center for Best Practices (NGA Center) and the Council of Chief State School Officers (CCSSO) joined forces to create common standards in English Language Arts and Mathematics for students to be college and career ready by the time they graduate from high school (Core State Standards Imitative, 2012). The draft of the College and Career Readiness Standards (CCR) were released in September 2009 for feedback by the states, organizations, and the public and in June 2010, the Common Core State Standards (CCSS) in English Language Arts and Math were established.
Though there are issues regarding HSGPA and its make up, it still remains the most valuable tool admissions counselors have in determining the future academic success potential candidates. It affords colleges and universities a glimpse of what type of work a potential candidate is able to achieve; much the same way that CGPA is valuable in looking at future semesters and degree completion, past performance is a great predictor of future performance.

Standardized Testing

Rudolph and Thelin (1962) suggest that in an effort to achieve a “comprehensive system” (p. 432) of American higher education, the use of standardized testing was implemented throughout many public and private institutions. Since 1901 and the very first dissemination of the college-board entrance exams, there has been discussion on whether or not these exams (in and of themselves) can truly measure student potential for future academic success.

Standardized testing was born in the early part of the 1900s. The growth of both public and private institutions led to the standardization practices of finances, salaries, the severing of denominational ties as well as admissions practices (Rudolph & Thelin, 1962, 1990). Created by Carl Brigham, the original Scholastic Aptitude Test was “modeled after earlier IQ tests and regarded it as a measure of innate mental ability” (Atkinson, 2005, p. 16). Based on the configurations of IQ tests, the SAT sought to measure aptitude or, in other words, was designed to “predict an individual’s ability to profit from a particular type of training or instruction” (Atkinson, 2005, p. 15). Though the overall use and worthiness of these tests are debated in colleges and homes across America, they remain widely used and popular and, to some, for good reason. Standardized tests provide
insight into college success in that students will have to remember and maintain large amounts of information. Information that will need to be analyzed, interpreted, understood and implemented. These tests provide a common metric across different disciplines and maintain the appearance of being objective in nature (Sternberg, 2010). Additionally, and perhaps one of the most advantageous reasons institutions use these tests is because the entirety of the expense lies with the student. It should be noted that the SAT has undergone several iterations over the past several decades and has therefore changed the meaning of its acronym. What began as the Scholastic Aptitude Test, morphed to the Scholastic Achievement Test and then morphed again into the Scholastic Assessment Test. Currently, the SAT, does not stand for anything, but maintains its status as the most commonly used entrance exam in the nation (College Board, 2012).

The most recent iteration of the SAT Reasoning Test is comprised of three components: (a) “critical reading”, which contains two sub sections (formerly known as “verbal”), (b) Mathematics, which contains three subsections, and (c) a new written section, containing two sub sections. The Mid-western answer to the SAT is the ACT. Designed in the same vein as the SAT, the ACT is comprised of four sections, including English, Mathematics, Reading, and Science reasoning. The latest iteration of the ACT also has an optional writing component however; this score is not compiled into the composite score (Sternberg, 2010).

The SAT and the ACT were created in order to deal with an explosion of college goers, especially after the Second World War. Institutions needed a method for admissions that streamlined the decision making process. Though it was intended to measure student ability to be successful in higher education, many professionals in
academia had concerns regarding this mode of examination. Indeed, concerns regarding the SAT date back to the 1940s and even earlier. During this time, researchers concerns were that the SAT was merely a multiple choice IQ test and would rather the focus be placed on achievement testing rather than aptitude assessment (Atkinson, 2004, 2005). Furthermore, the creator of the initial IQ test, Alfred Binet, suggested that though intelligence testing was useful in clinical setting, its use in the “rank order of individuals” was rejected (Atkinson, 2005, p. 16). In fact, years after its creation, Brigham, expressed doubts about the validity of the SAT, stating, “he worried that preparing for the examination distorted the educational experience of the high school student” (Atkinson, 2005, p. 16).

To date there is no study that concludes that SAT or ACT scores alone can be used to predict the eventual success of college students. Crouse and Trusheim (1988) suggest from their research that the SAT-I does not serve as a good predictor of either short or long term academic success. High school grades and class rank remain the most effective determinants of academic success (Perez, 2002). Given the research findings, many colleges and universities are beginning to embrace alternative measures and tools for admission. The University of California, Berkley and a number of liberal arts colleges have begun to make the SAT and ACT optional components of the admissions process. Some of these schools are in the top tier, according to Baron’s and US News and World Report and include not only the University of California, but other notable institutions such as Bates College and Sarah Lawrence College in New York (Epstein, 2009).

In October of 1984, Bates College became one of the first institutions to waive the SAT/ACT requirement, making them optional. After several decades of evaluation, Bates
College reported, “that the SAT did not add much power to predict a student’s CGPA” (Epstein, 2009, p. 12). Additionally, Epstein (2009) cites the Dean of Admissions and Vice President of Bates, William Hiss who stated that “for many of Bates’ students, the SAT is not predictive and, in some cases, is what statisticians would call a false negative…the test seems to suggest that the student cannot do good work when in fact they can” (Epstein, 2009, p.12).

In a report by the former Chairman of the University of California, Berkley, originally, a supporter of standardized tests, stated that, “first year performance data for the students admitted to UC Berkeley in Fall 2002 with SAT scores below 1000 indicate that no one has left due to academic deficiency” (Atkinson, 2001 p.154). These findings suggest that potential college candidates may have much more to offer based on both academic and non-academic skills than can be revealed in a four-hour, single-day, standardized testing situation.

For retention purposes, the ACT policy report of 2004, states that increased college performance was “strongest when ACT (and other standardized test scores) along with HSGPA and socio-economic status were combined with academic self-confidence and achievement motivation” (Lotkowski et al., 2004, p vii). This report continues to suggest that without several other contributing factors (i.e., academic self-confidence, academic goals, student integration, institutional commitment, social support, and involvement) many students may still be at risk of dropping out (Lotkowski et al., 2004; Sparkman et al., 2012; Tinto, 1993). Moreover, the report made no such claim that standardized testing, on its own, can predict academic success.
Regardless of this fact, the SAT and ACT remain the most widely used standardized measures for college entrance in the nation. As previously stated, the SAT has gone through several iterations. Robert Sternberg (2010) asserts that though there seem to be a multitude of reasons given for the switch, the most “obvious one is that neither the College Board nor anyone else is quite sure what the test measures, simply because it is not based on any particular scientific theory of a psychological construct, but rather on a pragmatic assessment of what will predict scholastic success in college” (Sternberg, 2010, p. 41).

In 2008, the National Association for College Admissions Counseling (NACAC) was charged with reviewing of the role standardized tests such as the SAT and ACT play in the American college admissions process. Growing concerns on the legitimacy of these tests to accurately predict impending success of college students had reached its summit. Therefore, the NACAC conducted a year-long study into the use of standardized tests in undergraduate admissions. Indeed the authors of the study concluded:

A growing field of research, in education and psychology, suggests different approaches to evaluation that may allow for broader and more inclusive review of individual talents. The theory of multiple intelligences, for instance, suggests, “human cognitive competence is better described in terms of a set of abilities, talents, or mental skills” called “intelligences.” (Gardner, 2006 as cited in NACAC, 2008, p. 18).

Additionally, the NACAC report states:

Colleges most often determine the utility of admission test scores by assessing how predictive they are of first-year grades. This report underscores that as such,
standardized admission tests should not be considered as sole predictors of true college success. Commission members unanimously agreed that college success is a term of sufficient breadth that it includes degree attainment, a wide range of GPAs, and the acquisition of experiences and skills that will propel a student into the workforce, graduate education or responsible citizenship. For this broad definition of success, standardized admission tests—as well as other individual factors—are insufficient predictors of a student’s likelihood of overall success (NACAC, 2008, p. 43).

The desire on the part of many colleges, universities, faculty members, admissions counselors, parents and students to move on from the traditional method of SAT and ACT scores within admissions requirements is growing. However, moving in this direction does not come without criticism even with the 2008 report from the NACAC. Those who oppose getting rid of the SAT/ACT requirement cite years of studies on the predictive validity of the SAT specifically, in combination with high school grades as the best predictor of college success higher education. In 2000, the College Board suggested in its publication that:

The SAT has proven to be an important predictor of success in college. Its validity as a predictor of success in college has been demonstrated through hundreds of validity studies. These validity studies consistently find that high-school grades and SAT scores together are substantial and significant predictors of achievement in college (Camara & Echternacht, 2000, p. 9).

Though this statement may have truth, the argument itself is false. Empirical research on the standard SAT (or ACT) and its ability to accurately predict success on its
own, is lacking. Until there is more research in this area, it cannot be concluded that the SAT/ACT aptitude tests are the only means by which college success can be deemed. Furthermore, the ability of the SAT/ACT to predict college success beyond the freshman year has also yet to be proven (Hunter & Samter, 2000; Zwick & Sklar, 2005).

Criticism of standardized testing is not only about its predicative validity, but also about the bias that many feel are contained within the test itself. Many researchers have concluded that the SAT has issues with cultural bias as well as issues of socio economic bias (Atkinson, 2001; Geiser (with Studley), 2002; Sternberg 2010; Walpole et al., 2005; Zwick & Sklar, 2005). Gose and Selingo (2001) suggest a significant gap between the SAT scores of White and Asian-American students versus that of their Latino and African American counterparts. One possible and simple reason for this gap is the multi-billion dollar industry that has been created around taking the SAT/ACT examinations.

The role of college preparatory courses in the United States is overwhelming. The countless number of books, DVD’s, computer courses and private preparatory instruction, as well as courses given in high school that amount to taking the SAT/ACT and is available to students, especially students with means is vast (NACAC, 2008; Sternberg, 2010).

Concerns regarding both the SAT and ACT and their role in higher education have been argued since their inception in the 1940’s. These examinations were viewed as nothing more than “multiple choice” versions of IQ tests (Atkinson, 2005, p. 15). Though many people both in and out of the academic arena view these examinations as effective tools in measuring students’ abilities, it is because of their inconsistencies that both admissions counselors and universities, as a whole, have taken their use to task, for
everything from cultural biases to corrupting the educational experiences of millions of high school students (Atkinson, 2005; Atkinson & Geiser, 2009; Sternberg, 2010). The claim for standardized testing rests on its ability to provide insight into students’ cognitive and intellectual capabilities. However, for many students, this picture may be incomplete. There is a vast amount of literature on what will make students successful in college; such as motivation, (Kaufman et al., 2007; Pintrich & Schunk, 1996; Sternberg, 2010), persistence (DeBerard et al., 2004; Kirby & Sharpe, 2001; McGrath & Braunstein, 1997; Ryland, Riordan, & Brack, 1994), self-regulation (Borkowski, Carr, & Pressley, 1987; Halpern, 1996; Iran-Nejad & Chissom, 1992; Schapiro & Livingston, 2000), and thinking disposition (Halpern, 1998; Pascarella & Terenzini, 2005; Stupinsky, et al., 2008). This stream of research suggests alternative methods of evaluation are providing colleges and universities with a more complete picture of students and their actual capabilities (Atkinson, 2004, 2005; Atkinson & Geiser, 2009; Sternberg, 2010; Tough, 2012).

**Alternative Measures**

Alternative measures such as emotional intelligence and control (Robbins et al., 2006) as well as other cognitive variables such as self-regulation, self-awareness and critical thinking skills, add additional and often valuable information on what may lead students to achieve success (DeBerard et al., 2004; Lotkowski et al., 2004; Shapiro & Livingston, 2000). Additionally, non-academic factors, such as academic “student readiness” (Kaufman et al., 2007; Robbins et al., 2006) self-confidence, academic goals and social support (Lotkowski et al., 2004) may also provide a model for success. Perhaps in the future these alternative methods will become more prominent in the
admissions process, affording students the opportunity to display talents not measured on exams and in classrooms.

Though alternative measures for determining eventual college success are becoming more acceptable they are by no means the norm. Sternberg (2010) suggests that colleges and universities can do better in terms of not just college admissions, but in terms of instruction and assessment as well. Sternberg (2010), argues that “if we think about students’ abilities in a broader way than we have-in particular, by valuing, assessing and teaching for analytical, creative, practical and wisdom-based skills as well as memory-related ones” (p. 5) we may be better off.

**Cognition and Student Academic Success**

The most widely used skill in academics, at any age, is the ability to think. Though there is a need now more than ever before for active and creative thought processes’, thinking outside of the box has rarely been encouraged outside of fine arts courses and classrooms. As we move into the 21st century, the call for creative and out of the box thinking, when it comes to college admissions is getting louder (Atkinson, 2005; Kaufman et al., 2007; Lotkowski et al., 2004; Robbins et al., 2006; Sternberg, 2010). Perhaps in the future these alternative methods will provide a model of success.

Students engage in thought processes in many different ways and have varied modes of thinking skills. Some students’ thinking skills may be higher order than others. Thus, their responses to issues both in and outside of the classroom can be as varied as their thought patterns (Lynch & Wolcott, 2001). Regrettably, there is a significant amount of data within the literature that suggests that many college graduates have a limited ability to handle situations which may have no single best answer (Eyler & Giles,
1999; King & Kitchner, 1994; Langer, 1989; Lynch & Wolcott, 2001; Wolcott & Lynch, 1997) or situations, which may have multiple answers and perhaps are more about process than precision. Researchers have identified a number of components essential for thinking skills; not just for academic success, but, success as an individual and contributing member of society. Beyer (2008) suggests that in order to be an effective thinker that creates and achieves success, academically and otherwise, one must be able to improve effective thinking skills by developing:

…skills such as decision making, problem solving, drawing conclusions, interpreting written texts, analyzing multiple sources, and identifying cause-and-effect relationships as well as various critical-thinking skills, such as judging the strength of an argument, distinguishing factual claims from value judgments, detecting bias, identifying points of view, and determining the credibility of sources (Beyer, 2008, p. 224).

The ultimate question for institutions of higher education as well as other facets of the American educational system, including K-12, is how to impart this knowledge, skill, and ability on students.

**Strategic Thinking Skills**

To date, there is no unanimous definition of the term “strategic thinking” (Boon 2001; Fairholm & Card, 2009; Goldman & Casey, 2010; Liedtka, 1998). However, there are some agreed upon principles of strategic thinking by leaders in the field. For example, Mintzberg, (1994), suggested that strategic thinking is a “synthesizing process utilizing intuition and creativity, whose outcome is an integrated perspective or enterprise” (as cited in Eaton & Lawrence, 1999, p. 3). Graetz (2002) asserts that the role
of strategic thinking is to seek innovation and imagine new and very different futures that may lead to the redefinition of core strategies and perhaps even goals. What these and other definitions have in common is that though strategic thinking is used as an “organizational term”, it is actually the individuals themselves that are within the organization that think in a strategic manner.

Though strategic thinking is an organizational term, in order for it to be achieved and for the individuals within the organization to develop these skills, organizations must actively choose to provide a place and environment for which these ideas and frameworks can take root. Organizations must provide supporting contexts for strategic thinking to succeed (Boon, 2001; Eaton & Lawrence, 1999; Liedtka, 1998) and become a part of the organizational culture.

Researchers agree that the ability to think strategically incorporates the ability to be creative, anticipate what may happen next and use previous knowledge and experience in combination with each other in order to achieve a new and perhaps more desirable outcome (Boon, 2001; Eaton & Lawrence, 1999; Graetz, 2002; Liedtka, 1998; Mintzberg, 1994; Pang & Pisapia, 2007, 2012; Pisapia, 2009; Pisapia et al., 2005).

Within the literature, there appears to be confusion with regard to the term strategic thinking. Often there is an assertion that strategic thinking is a part of strategic planning. Though this may in some cases be true, they are not mutually exclusive ideas, which is to say they are each their own distinct idea with its own set of goals and purposes (Boon, 2001; Liedtka, 1998). For the purpose of this research, strategic thinking is comprised of three separate and distinct sets of attributes in which individuals must
possess in order to be successful strategic thinkers. Figure 1, establishes the flow of a strategic mindset for an individual as well as for an organization.

For strategic thinking to occur an individual must be able to use reflection, or the ability to look back on previous experiences with a judgmental eye and understanding for what behaviors and actions may have been appropriate in the past but more importantly for what behaviors and actions were inappropriate or ineffectual responses in a given situation. Individuals must also possess the ability to use reframing, by looking at a given situation from alternative perspectives, perhaps through a different paradigm or lens (Bolman & Deal, 2003, 2008). Additionally, an individual must simultaneously possess the ability to think on a systems level; that is to look at the system or organization as a whole and in a holistic manner. Each of these used in conjunction with one another make up strategic thinking. The theoretical framework of this research suggests that to achieve
strategic thinking, or mindset, each of these components must work simultaneously. The ability to flow in and out of each skill and apply them to their full advantage is precisely the point of strategic thinking.

Stacey (1992), as cited in Liedtka (1998), suggests that “strategic thinking is not an intellectual exercise in exploring what is likely to happen, rather it is using analogies and qualitative similarities to develop creative new ideas” (p. 121). This idea is similar to what Pisapia, Pang, Hee, Lin, and Morris (2009) suggested, in that systems thinking, reframing and reflection are used as components within strategic thinking. It is the artistry of using these three interconnected cognitive functions that eventually leads one to develop and hone their skills as a strategic thinker. The question then becomes, how do we begin to impart this knowledge and skill set into those within our organizations, or for the purpose of this research, into our students?

One crucial factor is the manner in which this strategic thinking and mindset, is accepted by and within the organization, in this case, the academy. How can institutions of higher education begin to integrate these life skills into the world of academia? Will adopting this mindset be beneficial to the students and to the university community? What role will the institution play in developing and creating a forum for strategic thinking to occur?

Research into the creation of a strategic thinking as a mindset must be accompanied by an organization that provides room and context for strategic thinking skills to flourish (Boon, 2001; Goldman & Casey, 2010; Liedtka, 1998; Mintzberg, 1994; Pisapia et al., 2009). “The development of an individual’s ability to think strategically is
dynamic, interactive and an iterative experiential learning process” (Goldman & Casey, 2010 p. 121).

According to Wheatley (1992, 1999), the need for information and thinking skills which were once “the purview of top leaders, is moving deeper into organizations, as everyone needs to be able to interpret complex information and create their own realities” (as cited in Goldman & Casey, 2010, p. 120). The need for strategic thinking and the employment of its tactics is paramount. However, before it can be applied, it needs to be understood. The three components of strategic thinking, (a) reframing, (b) reflecting, and (c) systems thinking come from the model put forth by Pisapia et al. (2005).

In reframing an individual has the ability to change the paradigm in which they view situations, ideas, and their outcomes. This is a fluid activity that occurs naturally within one’s mind or cognitive process. However, like many other cognitive processes, the art of reframing is a skill that can be learned. Bolman and Deal (2003, 2008) refer to a frame as a lens. This lens allows individuals different ways in which to view and make sense of their world and reality. A lens or frame can limit ones view of the world, but by letting go of false or negative beliefs, another viewpoint has the capacity to emerge. Reframing is a cognitive function, one that can be taught and a skill that an individual can become quite adept at using. Cognitive reframing or cognitive restructuring is the ability to put a new frame around an old idea or though process. It is essentially a paradigm shift.

Bolman and Deal (2003, 2008) suggest that “the ability to reframe experiences enriches and broadens a leader’s repertoire and serves as a powerful anti-dote to self-entrapment” (p. 4). Reframing offers an individual the opportunity to view problems and
questions in a new way. It allows the individual to develop new ideas and perspectives in which new strategies can be developed and refined. The ability to reframe an argument or problem facing the organization can be the difference between success and failure. Failure to recognize new methods and problem solving models can lead to the demise of any organization, even an academic career. If students cannot navigate through their surroundings through new course work, professors and expectations, their ability to succeed is greatly reduced. The ability to perform in new surroundings, under new circumstances is what will set successful students apart and afford them the opportunity to achieve their goals within their college careers.

Webster’s New World Dictionary (1960) defines reflection in part as serious thought or contemplation. This thought or contemplation is done on a conscious level and is purposeful in nature, when it is a part of strategic thinking. Reflection is a part of reasoning and analysis. Reflection affords us the opportunity to assess our thoughts, behaviors, actions and feelings. Bolman and Deal (2003, 2008) suggest that, “reflection is or can be a spiritual discipline, much like meditation and prayer” (p. 433). King and Kitchner's (1994), ten-year longitudinal study on Reflective Judgment found that the ability to learn and use reflective judgment hit its peak during the later years of high school through well into the college years. In their study, three groups of subjects were used: (a) high school juniors, (b) college juniors, and, (c) doctoral students. The first iteration of their study tested all three groups using the Reflective Judgment Interview (RJI) in 1977. The second iteration, using the same RJI was in 1983 and the third iteration was at the ten-year point, in 1987.
The research revealed that the high school juniors, (most of which had graduated college by 1987) had the most dramatic increases in their reflective judgment scores, beginning at 2.9 in 1977 to 5.5 in 1987 (King & Kitchner, 1994). “This increase in the group mean score reflects change in epistemic assumptions ranging in from Stages 2 and 3 (stages on which the 1977 scores was predominately based) through stages 5 and 6 (for the 1987 score), a dramatic metamorphosis in thinking toward making reflective judgments” (King & Kitchner, 1994, p. 132). Indeed all three groups had an increase in scores at the ten-year point in 1987. Though some of the increases were small, they increased nonetheless. This research suggests that reflective judgment and perhaps the overall ability to think in a critical or strategic manner using more creativity and flexibility comes with age, experience and education (King & Kitchner, 1994).

Pisapia (2009) asserts that, “reflection is a cognitive skill that involves careful consideration of any belief or practice that promotes understanding of situations and then applies the newly gained knowledge to these situations” (p. 67). Reflection is a skill, a skill that can and should be taught in order for individuals to gain insight and perspective on past behaviors and performance. If used to its fullest potential, the art of reflection can change the manner in which information is processed and judgments are made, which in turn can guide future actions (King & Kitchner, 1994; Lynch & Wolcott, 2001; Pisapia, 2009).

Reflective thinking requires the continual evaluation of beliefs, assumptions, and hypotheses against the existing data and against other plausible interpretations of the data. The resulting judgments are offered as reasonable integrations or syntheses of opposing points of view. Because they involve ongoing verification and evaluation,
judgments based on reflective thinking are more likely to be valid and insightful than are beliefs derived from authority, emotional commitment, or narrow reasoning (Dewey, 1933 as cited in King & Kitchner, 1994, p. 7).

The ability to view organizations in a holistic manner can mean the difference between success and failure as well. Not just for leaders and managers, but for students. Senge (1990) asserts that because many executives need to maintain a sense of control, they fail to accept complexities within the organization. In order to accept these complexities, executives must “accept at a gut level that everything is interconnected” (Senge, 1990, p.15). In an interview on schools as learning organizations, Senge (1990) asserts that when it comes to K-12 education and creating a learning organization:

we always have to remind ourselves that school only works to the extent that it interfaces effectively with the whole world of the kid. I don't care how great the school is, if the kid goes out of that school into a completely dysfunctional world, it's going to be tough (as cited in Newcomb, 2003 p, 22).

Pisapia (2009) defines systems thinking as the ability to “understand the properties, forces, patterns and interrelationships that shape the behaviors of the systems and decide which options to provide for action” (p. 65). The capacity for individuals to understand the function of the organization and the people within it is paramount. Without understanding the nature of the organization and the manner in which it functions, one cannot claim to be a part of nor successfully navigate that system. For a student to be successful within the confines of each class, they must understand exactly what each individual professor requires. They must understand that each course needs to be prepared for in a different way and that no two courses or professors are alike. The
sooner students choose to understand this fact and successfully navigate around their new environment, the more likely they will find success, not just in their course work, but within their college experience as well. Systems’ thinking allows individuals to see patterns and inter-relationships. It requires that the individual is part of the feedback process and not apart from one (Pisapia, 2009).

In research conducted by Pisapia et al. (2006) on leader success, there was indeed a significant distinction between more successful leaders and their less successful counterparts and their strategic thinking abilities. Analysis revealed that “strategic thinking and leader success were significantly correlated ($r = .279$, $p < 0.001$) and a medium effect was produced and that strategic thinking explains 15.2% of the variance in leader success” (Pisapia et al., 2006, p. 22). Additionally, analysis suggested that the three components of strategic thinking (reflection, reframing and systems thinking) were all significantly related to leader success. However, it was determined by Pisapia et al. (2006) that systems thinking, “was the strongest predictor of success, followed by reflection and reframing” (p. 22).

Pisapia et al. (2005) used these definitions to guide their research in creating the *Strategic Thinking Questionnaire* (STQ). A panel of five experts, with backgrounds in strategic thinking was assembled to review the original 189 items, which were sorted into one of three categories (Pisapia, Morris, Cavanaugh, & Ellington, 2011, November). The result of the discussion and feedback sessions between the research team and the panel, led to the creation of the original version of the STQ. The STQ was created to measure the theoretically identified constructs of systems thinking, reframing and reflection (Pisapia et al., 2005).
The STQ has since undergone several iterations to improve and strengthen the scale from its original creation in 2005. In the first trial, the STQ was a 44-item survey used to study 136 for-profit and non-profit leaders by Pisapia et al. (2006). This trial was of little consequence, as it did not control for issues correlated with self-reporting as well as the inability for the three subscales, (reframing, reflection and systems thinking) to be empirically derived. However, in 2007, Pang and Pisapia began researching the use of strategic thinking skills of 543 school leaders in Hong Kong. After having the instrument translated into Chinese, having the subscales empirically supported, and controlling for issues with self-reporting data, a “link to leader effectiveness was found along with the importance of role and context in the use of strategic thinking skills” (Pang & Pisapia, 2012, p. 5).

The second iteration of the STQ was a 48-item instrument crafted in 2008. During this time, measures were included to “overcome potential bias found in self-reported data and convergent validity was established” (Pisapia et al., 2011, November, p. 5). In the next trial, Pisapia et al. (2009) conducted a “multi-country study of graduate students who were preparing for management positions” (Pisapia et al., 2011, November, p.5). During this study, the researchers were only able to uncover data that supported two empirical factors: systems thinking and reflecting. In reviewing these two factors, the researchers found that both skills (systems thinking and reflection) were influenced by age, experience and educational level. Simultaneously, a study by Zsiga (2008), working autonomously, conducted a study measuring self-directed learning readiness as well as leader effectiveness with (458) executive directors in the Young Men’s Christian Association (YMCA). Zsiga was able to create a fourth construct as an extension of the
original three by merging the three constructs into one. He called this construct strategic thinking orientation and Pisapia and Pang (2013) call it cognitive complexity.

Additionally, Zsiga’s research led to the use of manager evaluations as the measure of leader effectiveness. Furthermore, Zsiga’s 2008 trial “provided evidence of a positive relationship between (a) strategic thinking orientation and leader effectiveness, and (b) a robust association of the strategic thinking skills scale with the self-directed learning scale” (Pisapia, et al., 2011, November, p. 6).

In 2010, Raghavan, Shukla, and Shaid, a research team from India, validated the three original constructs. During this trial, they were also able to narrow the STQ’s empirically derived 48-items down to 20 items. This research looked at impact of strategic thinking on firm impact with 25 participants. The study concluded that, “cognitive diversity and strategic thinking were significantly related to long term firm performance of return on equity but not short term relative market share” (as cited in Pisapia et al., 2011, November, p. 6).

After each trial, the STQ was revised by examining previous research results and analyses from earlier iterations and discussions with the panel, the STQ moved onto version three. Version three of the STQ sought to become more accessible in part by altering the manner in which items were written, furthermore, five additional items were added to strengthen the subscales. The third iteration of the STQ has been used in six studies. One of those studies includes Brennen (2010) who sought to further the research started by Zsiga (2008). Brennen (2010) looked at the relationships between the use of strategic thinking orientation, authentic leadership and transformational leadership.
Penny (2010) also used the STQ, in a study that explored the relationship between strategic thinking skills and the use of technology.

In the case of Brennen (2010), after reviewing 806 cases of for-profit leaders, it was found that (a) “the relationship between authentic and transformational leadership, strategic thinking orientation significantly increases as the degree of strategic thinking orientation leadership increases” (Pisapia et al., 2011, November, p. 6) and (b) “strategic thinking orientation predicted transformational leadership as measured by Bass’s MLQ” (Pisapia, et al., 2011, p. 6). Penny (2010) used the STQ to research 122 National Executive Fire Chiefs in the U.S.A. Using systems thinking and reflection, the two previously empirically derived subscales, found that (a) “educational level, length of service, and age were positively associated with higher use of strategic thinking skills”, and that (b) “age was a moderator of the relationship of systems thinking, reflection and information and computer technology comfort” (Pisapia et al., 2011, November, p.6).

The three components of strategic thinking, systems thinking, reflection, and reframing must all work in concert with one another in order to be successful. When the three skills work together and become fluid it is recognized as cognitive agility. Creating this mindset can lead individuals on a path toward self-discovery and greater achievement. Strategic thinking is an evolutionary process, one that can be gained through insights and experiences (Pisapia, 2009; Pisapia et al., 2005; Pisapia et al., 2006; Pisapia et al., 2011, November). These experiences can be gained through trial and error through the course of everyday life events and organizational experiences, or they can be provided by an organization that is looking to grow, create and harness the experiences of
the individuals that serve it. Colleges and universities can provide students with an environment in which strategic thinking can prosper.

Schein (2004) identifies six ways in which leaders can aid in the development of a strategic mindset and embedding that mindset into the culture of the institution: (a) focus of leaders attention; (b) leaders role modeling and reactions; (c) criteria leaders use in their decision making process; (d) reactions to crisis and events; (e) basis for hiring, promotion and firing; and, (f) basis for resource allocation (as cited in Goldman & Casey, 2010, p. 121). The essential component for this to be successful, as with any new behavior or view that is trying to be implemented is consistency, not just within the organization, but also by the individuals themselves. Strategic thinking and mindset cannot just be a mantra or a mission statement; it must be an active practice that is done throughout the university in every office and classroom. This wisdom and art can then be passed down to our students, who in turn can create their own strategic thinking abilities.

**Academic Success**

Measures used to determine academic success will go beyond the traditional methods of standardized test scores and high school grade point average and into strategic thinking skills as a possible predictor of undergraduate academic success.

**Cumulative Grade Point Average (CGPA)**

Though few studies have looked beyond first year or freshman grade point average as a means of college success, many researchers agree that academic success is defined mostly in terms of college grade point average (Shivpuri, Schmitt, Oswald, & Kim, 2006). This outcome variable was chosen for the same reason that colleges and universities use HSGPA in determining whether or not a student will be successful,
during the admissions process. The best measure for future performance is past and repeated performance (Geiser, 2007; Geiser, (with Studley), 2002; Lotkowski et al., 2004; Sternberg, 2010). In a study by Geiser (2007), in looking at the validity of high-school grades in predicting college success, he found that CGPA tended to increase during the first four years of college and decrease when a student moves into the fifth year. Additionally, DeBerard et al. (2004) found that “a multiple linear regression equation predicting CGPA using 10 predictors accounted for 56% of the variance in academic achievement” (p. 72).

**Time to Degree and Degree Earned**

“Freshman class attrition rates are typically greater than any other academic year and are commonly as high as 20-30%” (Mallinckrodt & Sedlacek, 1987 as cited by DeBerard et al., 2004, p.66). For many universities, the retention of students is paramount. Whether or not a student returns to college semester after semester not only indicates their motivation, persistence and indicates eventual academic success, but also implies the success of the institution as well. Attrition during the freshman year not only cost students a great deal, but for the university the cost can be in the thousands. These dollars reflect not only the loss of tuition fees but more importantly the loss of potential alumni dollars as well (DeBerard et al., 2004). Porter (1990) estimates that “40% of college students will leave higher education without earning a degree” (as cited in DeBerard et al., 2004, p. 66). Time to degree is used as a criterion variable based on its importance to not only CGPA but also its necessity in obtaining a degree, which is achieved through academic success.
“While high school GPA and standardized test scores have been shown to be the best predictors of first year college success, recent research demonstrates that HSGPA and ACT scores are unrelated to the prediction of college graduation” (Schuh, 1999, p. 642 as cited in Sparkman et al., 2012). A majority of the empirical research on college success using HSGPA and standardized test scores rarely goes beyond predicting freshman year success. Few studies establish a link between HSGPA and standardized tests and their ability to predict college graduation (Hall et al., 2008; Schuh, 1999; Scott et al., 2006). As a criterion measure, time to degree is used to determine if more academically successful students take less time to earn their undergraduate college degrees than their less academically successful counterparts.

**Contextual Variables**

There is an abundance of literature based on the relationship between academic success and various contextual factors. For this study the contextual variables included age, gender, ethnicity, parental education and academic discipline. The majority of these questions, with the exception of academic discipline, which was retrieved through archival data sources, were placed at the end of the STQ (as the last seven questions on the document) and were obtained at the same time the survey was disseminated. These contextual variables will be used as moderators of academic success between predictor variables (STS, HSGPA, and SAT) and academic success outcome measures (CGPA, time to degree and degree earned).

**Age**

The literature on age and academic achievement is based on traditional aged college students versus non-traditional aged college students. The term “traditional age”
refers to individuals who are under the age of 21 and have moved directly from high school into higher education. The “non-traditional” student is described as over the age of 28, who may or may not be attending college or university for the first time, is usually employed (at least part-time), married and sometimes even has children (Bye, Pushkar, & Conway, 2007). Today, with changes in the economy and workforce requirements, more and more colleges and universities are educating older or non-traditional students. The National Center for Educational Statistics (NCES) (2004) states that one of the major differences between traditional aged students and non-traditional aged students is the context of learning itself. For many non-traditional students, the art of learning takes a more real life application process. Older, non-traditional students are more likely to incorporate new learning with various life roles in a more multidimensional way compared to that of their younger counter parts (Donaldson & Graham, 1999). Research on these two groups suggest that while older students may not be engaged in campus life and activities, their academic engagement and achievement is equal to and often greater than that of traditional aged students (Bye et al., 2007; Carney-Crompton & Tan, 2002; Donaldson & Graham, 1999). Perhaps this is true due in part to life experience.

Donaldson and Graham (1999) suggest that:

…adults integrate new learning by making connections to existing knowledge schema. They reflect on rich, personal experiences and draw on their previous knowledge and wisdom to make meaning of new material and to understand it in a way that transforms their own previous understandings (p. 27).

In terms of academic success as it has been defined for the purposes of this study, older students did as well or better than younger students during their academic careers.
based on their grade point average as well as aptitude or content based examinations (Donaldson & Graham, 1999). Though their reasons for attending university may be different, both traditional and non-traditional students seem to achieve academic success comparatively speaking.

Gender

A gender gap in higher education does exist, even today; though the gap seems to have been reversed. Today, women are out pacing men in not just enrollment but the completion of bachelor’s degrees (U.S. Department of Education, 2013), as seen in Table 12 in Appendix A. The situation with men falling so drastically behind women in not only obtaining a college degree but in academics in general has become so great that a bipartisan commission was created in 2010, requesting that President Obama create a “White House Council on Boys and Men”, as he did for women and girls in March of 2009 (White House, 2013; White House Boys Men, 2013). The concern seems to be that academic achievement, at all levels in education has boys/men behind which leads to issues later in life such as unemployment and divorce. Academic achievement of men, or lack thereof is growing not just in our colleges and universities but within our K-12 systems as well. Between 2000 and 2010, the enrollment in undergraduate programs rose by 37 percent. “During this period, male enrollment grew 36 percent, from 5.8 million to 7.8 million students, while female enrollment grew 39 percent, from 7.4 to 10.2 million students. In 2010, females accounted for 57 percent of undergraduate enrollment” (U.S. Department of Education, 2013).

In 2009-2010, women not only outpace men in the conference of a degree but also, did so over all ethnicities measured (U.S. Department of Education, 2013). Table 12
[see Appendix A] outlines the number of bachelor’s degrees awarded in the U.S. for the 2009-2010 academic years. This table shows the breakdown by gender as well as by ethnicity.

Table 12 [see Appendix A] shows that women are graduating in higher numbers than men across ethnicities as well as disciplines. Thus, their academic success is overtaking that of their male counterparts and has continued to do so by a significant margin since the early 1980’s (Buchmann & DiPrete, 2006). However, males do outperform females in some disciplines, including engineering and economics. This division can be seen within assessment tools used during K-12 and in preparation for college. In many standardized testing situations, boys tend to outperform girls on math assessments, where girls tend to outperform boys in reading assessments (White House, 2013). However, the research seems to suggest that women of every ethnicity are outperforming men and achieving greater levels of academic success including degree attainment within higher education (Buchmann & DiPrete, 2006; DiPrete & Buchmann, 2006; U.S. Department of Education, 2013; White House, 2013).

**Ethnicity**

This study looks at ethnicity to determine whether or not it plays any significant role in the ability to use strategic thinking skills effectively. In looking at academic achievement and ethnicity, some of the research seems to indicate that different tools predict the academic success of different races in different ways. For example, in a study done by Bryson, Smith and Vineyard (2002) research determined that the best predictors of first year college success for white students was the use of both HSGPA and standardized test scores. While for African-American students these predictors were not
viable for determining academic success. HSGPA and class rank were the best predictors of first year college success of Non-White students. While for African-American students, HSGPA alone was the single best predictor of freshman year success. Another study by Kirby, White, and Aruguete (2007) confirmed the results of the 2002 study by Bryson et al., for Asian Americans, a combination of mathematic standardized test scores and non-cognitive variables such as volunteerism were the best predictors of academic success (Ting, 2000).

These studies give weight and voice to what researchers, professors, administrators and even students within higher education have been saying for over a decade, standardized tests though they give some sort of snapshot of abilities should not be relied upon as a central tool that institutions use when selecting candidates during the admissions process (Atkinson & Geiser, 2009; Bryson et al., 2002; DeBerard et al., 2004; Geiser & Santelices, 2007; Geiser & Studley, 2004; Hall et al., 2008; Kirby et al., 2007; Lotkowski et al., 2004; Stupinsky et al., 2007; Ting, 2000). These studies and others, suggest that the use of standardized testing as a major part of or required component of an admissions packet may be restricting a wide group of potentially successful candidates from earning the degrees.

**Parental Education**

The research on the level of parental education and its effects on their children’s educational attainment are seemingly endless. As one might expect, parental educational level is both positively and significantly related to the academic success of their children (Dubow et al., 2009; Leppel et al., 2001; Naumann et al., 2003; Spera et al., 2009). Indeed, “one of the most consistent predictors of children’s level of educational
attainment is their parents’ level of educational attainment” (Spera et al., 2009, p. 1141).

This finding is not only true within the United States, but these positive correlations have been found in almost every other country (Social Situation Observatory, 2013). In a study on the long–term effects of parental education on children’s educational and occupational achievement, Dubow et al. (2009) found that the effects of parental education has an indirect effect on both their children’s educational achievements as well as their eventual occupational achievements:

A child exposed to parents who model achievement-oriented behavior (e.g., obtaining advanced degrees; reading frequently; encouraging a strong work ethic) and provide achievement-oriented opportunities…should develop the guiding belief that achievement is to be valued, pursued, and anticipated. This belief should then in turn promote successful outcomes. (Dubow et al., 2009, p. 3)

Buchmann and DiPrete (2006) suggest that parental educational background has a significant effect on women attending institutions of higher education. Research on “status attainment” establishes a link between parental education and family resources to “an individual’s educational attainment (Buchmann & DiPrete, 2006, p. 517). Figure 3 provides a snapshot on parental level of education and mean scores on each component of the SAT.
### SAT Reasoning Test

<table>
<thead>
<tr>
<th>Test-Takers</th>
<th>Critical Reading</th>
<th>Mathematics</th>
<th>Writing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>Pct</td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>All Test-Takers</td>
<td>1,494,531</td>
<td>100</td>
<td>502</td>
</tr>
</tbody>
</table>

### Highest Level of Parental Education

<table>
<thead>
<tr>
<th>Highest Level of Parental Education</th>
<th>Number</th>
<th>Pct</th>
<th>Critical Reading</th>
<th>Mathematics</th>
<th>Writing</th>
</tr>
</thead>
<tbody>
<tr>
<td>No High School Diploma</td>
<td>58,259</td>
<td>4</td>
<td>421</td>
<td>98</td>
<td>445</td>
</tr>
<tr>
<td>High School Diploma</td>
<td>413,137</td>
<td>31</td>
<td>466</td>
<td>98</td>
<td>476</td>
</tr>
<tr>
<td>Associate Degree</td>
<td>113,958</td>
<td>9</td>
<td>484</td>
<td>95</td>
<td>492</td>
</tr>
<tr>
<td>Bachelor’s Degree</td>
<td>398,895</td>
<td>30</td>
<td>522</td>
<td>103</td>
<td>533</td>
</tr>
<tr>
<td>Graduate Degree</td>
<td>353,262</td>
<td>26</td>
<td>560</td>
<td>109</td>
<td>569</td>
</tr>
</tbody>
</table>

*Figure 3.* Mean SAT scores by family income and parental education level. Adapted from “Report of the NACAC Commission on the Use of Standardized Testing in Undergraduate Admission,” NACAC Testing Commission Report, 2008.

**Academic Discipline**

This study will look at academic discipline of each subject to determine whether the college they earn their degree from had any influence on the relationship between predictor and outcome variables. Once this determination has been made, multiple regression analysis will be run to determine what, if anything, academic discipline contributes to either strategic thinking skills, academic success or both. If a relationship emerges from the multiple regression analysis for polychotomous variables gender, ethnicity and academic discipline, correlational analysis will be conducted.
Chapter Summary

This chapter looks at the literature from over a half a century of research on tools used to determine the academic success of students entering college or university. Much of the research does not go outside predicting success in college beyond the freshman year. This chapter also reviewed the history of Strategic Thinking Skills, specifically the model created by Pisapia et al. (2005) to determine its usability in predicting the long-term academic success of college students. Finally, the literature on contextual variables used in studies, which may influence college success, was reviewed. Age, gender, ethnicity, parental educational background, and academic discipline were established as potential moderators.
CHAPTER III.

METHODOLOGY

The purpose of this study was to determine how thinking skills used by college students prior to university matriculation, high school grade point average (HSGPA), and standardized test scores (SAT) are related to their college grade point average (CGPA), Time to Degree, and Degree Earned. Specifically, this study sought to answer two important questions: (a) what strategic thinking skills (STS) do college students use prior to university matriculation and (b) how do the students’ use of these skills compare to HSGPA and standardized testing scores in predicting academic success? This chapter describes the methods and procedures used to collect and analyze the data and is divided into the following sections: (a) research design, (b) review of research questions, (c) instrumentation, (d) data collection procedures, and (e) and the methods used to analyze the data.

Review of Research Questions and Null Hypotheses

This study seeks to answer two important questions. Are thinking skills possessed by college students prior to university matriculation related to their academic success in college? Are these skills more valuable in predicting academic success than standardized test scores or HSGPA? Four sub questions guided the research study, design, data collection and analysis.

1. What strategic thinking skills (STS) do entering freshman possess?
2. What is the relative contribution of each predictor variable to predicting academic success variables?

3. Are these relationships moderated by contextual factors?

This research study is framed by six constructs: (a) HSGPA, (b) standardized test scores, (CGPA), (c) cognition, (d) context, and (e) student outcomes (academic success). This framework suggests that student ability is expressed through, high school grade point average, standardized test scores, cumulative grade point average and through the way they think. Using multiple regression analysis, simple correlations, two null hypotheses inspired by the theoretical underpinnings of this study were tested:

H₀₁: There are no significant relationships between the use of STS, HSGPA and SAT scores and undergraduate student academic success.

H₀₂: The relationships of STS, SAT, and HSGPA and undergraduate student academic success are not significantly influenced by moderating contextual factors.

**Research Design**

This study employed a quantitative non-experimental longitudinal research design. The study was conducted in three phases over four years. During the first phase, the strategic thinking skills of entering freshman were identified. During Phase I, *The Strategic Thinking Questionnaire* was administered to a wide cross section of first semester freshman from various disciplines. The second phase, Phase II involved obtaining the HSGPA and SAT/ACT scores for the students taking the STQ from University archival data. During this time all students who had taken the ACT had their composite score converted to a
combined score for the SAT using a concordance table shown in Table 13, in Appendix B, provided by the College Board (2009) Office for Research and Development, as this measure is commonly used by admissions counselors in order to “understand how students of comparable ability would score on the two college entrance examinations” (College Board, 2009). This score, whether the original SAT score, or that calculated from the ACT score using the concordance table, will elsewhere be referred to as the SAT.

Phase III, which took place each subsequent semester, were used to review subjects retention status (did they enroll each semester), CGPA and during the summer 2013 semester and fall 2014 semester, university archival data was reviewed to see which subjects earned undergraduate degrees. Subject’s Time to Degree (measured in semesters) and Degree Earned was evaluated to determine if subjects earned their degrees early or on time (within the 4 year time-frame). Subjects who had left his/her program of study, or the university for any reason, for more than one academic year was omitted from the final data pool. Additionally, any student who did not stay continuously enrolled for more than one academic year was also omitted from the final data pool.

Predictor variables in this study are strategic thinking skills, HSGPA and SAT scores. Moderator variables were used to determine what, if any, influenced the relationship of the predictor variables on the criterion variables. They included age, gender, ethnicity, parental educational level and academic discipline. Criterion variables used in this study were College Grade Point Average, Time Degree, and Degree Earned.
In determining academic success on a longitudinal scale, this study examined outcome indicators, college grade point average, time to degree, and degree earned as the model for achieving undergraduate academic success. Using the traditional four-year time frame, this study allowed for students in various academic disciplines the opportunity to obtain Bachelors of Arts or Bachelors of Science (or degree equivalent) as most undergraduate programs are timed in this fashion. The four-year time frame was chosen on the basis of both State and Local policies, but also based on the national attention higher education has received from the Obama administration, in the *State of the Union Speech* in January 2012, where a renewed focus on the quality and affordability of colleges was in the spotlight (White House, 2012; FAU, 2013). Table 2 provides an outline of all of the variables considered in this study, how they were identified, and how they were measured.
### Table 2

**Research Variables, Definitions, and Measurements**

<table>
<thead>
<tr>
<th>Study Variable</th>
<th>Identification</th>
<th>Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Predictor Variables</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strategic Thinking</td>
<td>Ability to change paradigms and frames across multiple perspectives to gain new insight and implement new actions (Pisapia et al. 2005).</td>
<td>Likert scale scores (5= almost always; 1= almost never)</td>
</tr>
<tr>
<td>Reframing</td>
<td>Ability to change paradigms and frames across multiple perspectives to gain new insight and implement new actions (Pisapia et al. 2005).</td>
<td>STQ™ items #12,18,25,28</td>
</tr>
<tr>
<td>Reflecting</td>
<td>Use of experience, information and perception to create and guide future action (Pisapia et al., 2005)</td>
<td>STQ™ items #20,30,31</td>
</tr>
<tr>
<td>Systems Thinking</td>
<td>Ability to understand the holistic behavior of the organizational system (Pisapia et al. 2005).</td>
<td>STQ™ items #1,16,27,29,37</td>
</tr>
<tr>
<td>Cognitive Agility</td>
<td>The degree to which a person uses a wide array of thinking skills</td>
<td>STQ™ all items</td>
</tr>
<tr>
<td>High School GPA (HSGPA)</td>
<td>The computation of high school grades as submitted by the student on their college application and which appears on their high school transcript at the time of entry into the University.</td>
<td>HSGPA as it appears on transcripts at time of entry into the college. 4.0=A; 3.0=B; 2.0=C; 1.0=D; continuous scores ranging between 4.0 – 0.0</td>
</tr>
<tr>
<td>Standardized Tests</td>
<td>Standardized test scores as submitted by the student’s high school and as it appears on their high school transcript at the time of entry into the University.</td>
<td>Continuous scores SAT scores range between 200-1600;</td>
</tr>
</tbody>
</table>
By University policy, an undergraduate student’s grade point average is computed by dividing the sum of all grade points earned by the total number of credits in all courses for which the grades of “A” through “F” have been received. Courses in which grades of “AU,” “CR,” “W,” “WM,” “S,” “U,” “I” or “P” have been received have not be used in computing a student’s grade point average as it appears on the student’s university transcript at time of college graduation. 4.0=A; 3.0=B; 2.0=C; 1.0=D. Continuous scores ranging between 4.0 – 0.0; scores retrieved from the university database.

Defined as the number of semesters enrolled prior to receiving degree sought. Data retrieved from university database.

Students admitted to FAU as freshmen are expected to complete their degree program within four years. (The typical degree program requires 120 credits. Degree programs requiring more than 120 credits may require one-to-three additional semesters, depending on the program.) To graduate in four years, students must successfully complete an average course load of 15 credits every semester. Students should enroll in summer courses so as to lighten their load in semesters when taking particularly difficult courses and to ensure progress toward their degree. All students entering FAU with fewer than 60 credits are required to earn a minimum of 9 credits in the summer, according to Florida Board of Governors Regulation 6.016.
<table>
<thead>
<tr>
<th>Study Variable</th>
<th>Identification</th>
<th>Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Moderator Variables</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>Age at the time the survey was completed.</td>
<td>Self-reported on survey Continuous scores</td>
</tr>
<tr>
<td>Gender</td>
<td>Male or Female</td>
<td>Categorical scale 1= Female 2= Male</td>
</tr>
<tr>
<td>Ethnicity</td>
<td>Race</td>
<td>Categorical scale 1=African American 2=Asian 3=Hispanic 4=Caucasian 5=Other / Not Identified Categorical scale</td>
</tr>
<tr>
<td>Parent Education Level</td>
<td>Educational level of mother (EOM) and education of father (EOF) of student. Information was self-reported by student selected from options provided on questionnaires.</td>
<td>Self-reported by student 1=No Degree 2=HS Diploma 3=Associates Degree 4=Bachelors Degree 5=Masters Degree 6=Specialist Degree 7=Doctoral Degree</td>
</tr>
<tr>
<td>Academic Discipline</td>
<td>College from which degree was awarded at time of graduation</td>
<td>Categorical scale Retrieved from university database 1=Colleges of Arts and Letters 2=College of Business 3=College of Design and Social Inquiry 4= College of Education 5= College of Engineering 6=College of Nursing 7=College of Science</td>
</tr>
</tbody>
</table>
Participants

The sample for this study included 229 first semester freshmen. Approximately 34 courses were identified as typical freshman level courses. Of these 34, 14 classes of approximately 800 students completed they survey. These students were enrolled in one of six courses: (a) General Chemistry One: CHM 2045, (b) Life Science: BSC 1005, (c) Skills for College Success: SLS 1503, (d) College Writing I: ENC 1101, (e) Communications: COM 3014 and (f) Information Systems Fundamentals: ISM 2000. These courses were chosen due to their large enrollment number, as this would provide the largest cross section of students from various disciplines throughout the University. Participating students represented all Colleges within the University. They include: the College of Arts & Letters, College of Business, College of Design & Social Inquiry, College of Education, College of Engineering, College of Nursing and College of Science. Table 3 provides a list of the courses used in this study as well as the total number of participants responding per class, regardless of their class status (i.e., freshman, sophomore, junior and senior).
The STQ was disseminated to all the students in each of the classes. There were approximate 800 surveys disseminated, of those 800, approximately 358 were freshman. After the data was cleaned, the data pool consisted of 229 first semester freshmen. This subject pool was specifically chosen in order to mitigate the effects of college life, course work and adjustment on their academic success. Participants were briefed about the study, its risks explained and that participation was completely voluntary. Confidentiality was guaranteed and by submitting the survey to the researcher, participants agreed to have their records reviewed as the study entered into the data analysis phase. Participants were verbally made aware that they could withdraw from the study at any point without incident by contacting the researcher via email.

### Table 3

_Courses for STQ Undergraduate Dissemination_

<table>
<thead>
<tr>
<th>College</th>
<th>Department</th>
<th>Course</th>
<th>Course Number</th>
<th>Approximate Enrollment (per class)</th>
<th>Number of Sections Tested</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arts &amp; Letters</td>
<td>English</td>
<td>College Writing I</td>
<td>ENC 1101</td>
<td>22</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Communications &amp; Multimedia Programs</td>
<td>Communications</td>
<td>COM 3014</td>
<td>28</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Communication</td>
<td>Learning Strategy &amp; Human Development</td>
<td>SLS 1503</td>
<td>25</td>
<td>3</td>
</tr>
<tr>
<td>Business</td>
<td>Information Technology &amp; Operations Management</td>
<td>Information Systems Fundamentals</td>
<td>ISM 2000</td>
<td>229</td>
<td>1</td>
</tr>
<tr>
<td>Science</td>
<td>Chemistry &amp; Biochemistry</td>
<td>General Chemistry</td>
<td>CHM 2045</td>
<td>293</td>
<td>4</td>
</tr>
<tr>
<td>Biological Science</td>
<td>Life Science</td>
<td>BSC 1005</td>
<td></td>
<td>287</td>
<td>1</td>
</tr>
</tbody>
</table>
Instrumentation

The Strategic Thinking Skills Questionnaire: Forty-three (43) validated items from the STQ were used in this study. The instrument contains “safe-guards” that protect against the inconsistencies that sometimes accompany self-reporting data. In all cases, these safeguards were applied and deficient data removed prior to analysis. Average to above average scores on the STQ suggest that the respondents were effective in using the strategic thinking skills; meaning that he or she was most likely to possess the skills of a strategic thinker. An inability to be an effective strategic thinker was suggested by lower scores.

As noted in Chapters I and II, the STQ has been studied within the context of several populations, including professionals, leaders, and managers in both for-profit and non-profit agencies as well as with graduate students. The STQ has also been translated into different languages and used by researchers in six different countries, including China (Mandarin and Cantonese), Malay, India, Iran, Turkey, as well as the United States. It appears to be generalizable to a broad cross-section of society. However, due to the nature of differing item responses based on age, education, organizational position, and experience level, the STQ may perform differently based on the population being examined (Pisapia et al., 2011, November)

The STQ takes approximately fifteen minutes to complete and is capable of being either self-scored or electronically scored. All subjects were given the paper version of the instrument. Each survey was electronically scored and coded into SPSS with the assistance of Florida Atlantic University’s Office of Institutional Effectiveness. To overcome validity issues inherent in self-reported instruments, the STQ contains two
indicators: (a) Omission Rate (number of omitted responses), and (b) an Inconsistency Index (degree of response inconsistency). If scores on the paired items deviated more than one point, the case was eliminated from the overall analyses. The survey also contains seven reverse-scored items to reduce the effect of patterned answers.

The survey directed students to rate how often they used strategic thinking skills when faced with a problem, dilemma or opportunity. Responses were recorded using a Likert-type scale: 1=\textit{rarely or almost never}, 2=\textit{once in a while}, 3=\textit{sometimes}, 4=\textit{often}, and, 5=\textit{frequently or almost always}. The last seven survey questions request demographic information, (i.e., age, gender, ethnicity, and parental educational level). Information regarding subject’s academic discipline was recorded at the time of final analysis during Phase III. Additionally, participants supplied identifier information such as name, date of birth, and student Z-number—an identification number used at Florida Atlantic University, in lieu of a social security number, as a tool for enrollment, financial aid, advisement, and registration. The student Z-number is unique and protects the students’ privacy (FAU, 2012) and was deemed necessary to collect archival data.

**Validation of Instrument**

Finding no existing valid measures, Pisapia et al. (2005) worked to define three meta-cognitive skills that taken together create strategic thinking. The researchers also hypothesized that the use of these skills would be used differently between more effective and less effective leaders (Pisapia et al., 2005). These three cognitive skills have been previously identified in Table 2, Chapter I.
Pisapia et al. (2011, November) subjected 1,117 cases of participants holding leadership positions in for-profit or nonprofit sectors in the USA from the research previously cited to empirical analysis in order to determine latent factors, means and standard deviations. The panel found that the STQ “appears to be generalizable to a wide spectrum of society,” “no significant threats to reliability” (Pisapia et al., 2011, November, p. 12). They reported alphas of .76 for systems thinking, .73 for reframing, and .76 for reflection (Pisapia et al., 2011, November, p. 10). The panel conducted a confirmatory factor analysis and applied Hu and Bentler’s (1999) recommendations in regards to fit indices to their results. They reported that Hu and Bentler (1999) suggest that an acceptable CFA fit model is characterized by the following values: Comparative Fit Index (CFI) >.90, Root Mean Square Error of Approximation (RMSEA) < .10 and Standardized Root Mean Squared Residual (SRMR) <.08. Pisapia et al., (2011, November) concluded that on those indices the model demonstrated a good fit to the data and that, “Results from confirmatory analysis are a good fit with the original three subscale model” (p. 11).

Data Collection

Data were collected in three phases over four years; Phase I included the actual administration of the STQ. Phase II included the collection of all archival data, and in Phase III data analyses was conducted. Data were collected on the predictor variables in a study approved by Internal Review Board (IRB), seen in Appendix C, completed during the 2009 fall semester. The researcher made contact with various professors throughout the university, in all disciplines in order to gain access to freshman students. The courses defined in previous paragraphs were chosen based on
class size and the willingness of professors to have their students participate in the study. Once access was granted, the researcher attended the first 15-20 minutes of each course (prior to academic instruction) to obtain maximum participation.

**Phase I**

During the 2009, fall semester and (for the 2009-2010 academic year), the STQ surveys were disseminated. Upon entry into the class, the researcher made an introductory statement on the research topic and briefed students on the purpose of the study. A debriefing statement, included the right to confidentiality, and the use of their student identification information, (i.e., Z number), was made by the researcher during this time. During the debriefing, a statement was made by the researcher that, by participating in the study and completing the STQ survey, subjects agreed to have what would eventually be their archival data (high school grade point average, standardized test scores, college grade point average and degree earned status) analyzed for purposes of this research only. Students were made aware that participation in the research study was completely voluntary and that they could withdraw from the study at any time without incident by contacting the researcher through email. Students were given the researchers’ university email address should they wish to have been removed from the study. No participants made contact with the researcher or asked to be withdrawn from the study.

Next, students were given the paper version of the STQ. At the beginning of the survey, participants were asked to enter their name and Z-number to allow the researcher access to archival information at a later date. If participants did not enter his/her name or Z-number, he/she was automatically omitted from the data pool. Additionally, a verbal
cue was given by the researcher to the participants requesting they hand write, in the upper right hand corner, their current academic standing according to the number of credits earned. Participants entered one of the following: (a) F for freshman (less than 30 credits), (b) S for sophomore (31-59 credits), (c) Jr. for junior (60-89 credits), and, (d) Sr. for senior (90-120 credits). This information was inadvertently left off the survey, however was deemed necessary for data analysis. Only those surveys with the letter “F” (freshmen participants) were retained for use in this research; remaining surveys were excluded from the data pool.

**Phase II**

Data was collected on the moderator and criterion variables both on the STQ itself and through archival data sources, during the summer of 2013 and fall 2014 semesters. Information gathered from the university data system regarding participant’s high school grade point average, standardized test scores, as well as college grade point average and enrollment status for each participant and any graduation information was obtained and assessed at this time. Again, students who were not enrolled from more than three consecutive semesters were omitted from that final data pool.

**Phase III**

Once the data collection process was complete, the researcher, according to the STQ scoring instructions, scored each survey. Data was then entered and analyzed. The analysis of all of the surveys was completed using SPSS v 22. After the data cleaning process (omitting of surveys which were for any reason incomplete or students who were no longer enrolled) descriptive statistics, including means and
standard deviations were analyzed. Subjects who were missing data on the demographic variables were excluded from analysis in moderator questions.

**Data Analysis**

The two null hypotheses engendered by the theoretical underpinnings of this study were tested and analyzed. In determining which predictor variables have relationships in predicting academic success, data from the STQ was compared to commonly used predictor variables HSGPA and SAT in predicting whether or not students were (a) academically successful in achieving a college grade point average above a 2.0, (as this is the university requirement to earn a bachelor’s degree) and (b) continuously enrolled and obtained a degree within a four-year time frame (or earlier).

**H₀₁:** There are no significant relationships among the use of STS, HSGPA and SAT scores, in predicting undergraduate student academic success. Simple correlations between the predictors, STS, HSGPA, and SAT and CGPA, as well as a multiple regression between the STS scores, HSGPA and SAT and CGPA, Time to Degree and Degree Earned were used to test the hypothesis.

The question of whether a relationship between predictors STS, HSGPA and SAT and academic success variables varied as a function of contextual variables was used to test the second hypothesis. In this analysis, the contextual variables included: age, gender, ethnicity, EOM, EOF and academic discipline. Therefore:

**H₀₂:** The relationships of STS, HSGPA, and SAT and undergraduate student academic success are not significantly influenced by moderating contextual factors.
In order to analyze the data for $H_02$, multiple regressions were completed for all contextual variables. For continuous variables centering was completed prior to analysis in order to avoid issues with collinearity. For both continuous and nominal moderators, multiplying the moderator times each predictor variable creates a product term. The only difference between the variable types is that, in the case of nominal variables with more than two categories, the moderator must be dummy coded and is not centered. A test of the contribution of the product term(s) to total variance explained served as the test of moderation. This process was completed for moderator variables gender, ethnicity and academic discipline. If a significant relationship was found, then each level of the moderator was tested to see which was significant.

**Limitations**

Results from this study are limited by operations. Several steps and indices were created to mitigate the negative effect of self-reported data, Pang and Pisapia (2012) summarized the issue accordingly: The reliability of using self-ratings as a measure in research studies has been reviewed by a number of writers without reaching conclusive universal consensus on their effectiveness (Atwater & Yammarino, 1992; Harris & Schaubroeck, 1988; Smither et al., 1995; Weisband & Atwater, 1999; Yammarino & Atwater, 1997 as cited in Pang & Pisapia, 2012, p.351). Though there is a tendency for self-reported data to be inflated (Spector, 1992) the STQ$^{TM}$ was designed to elicit individual preferences and behaviors without influencing the respondent toward or away from any particular selection.

As explained in previous paragraphs the STQ contains safeguards to overcome the effects of self-reporting. These safeguards were applied and cases were removed
before the data was analyzed. Furthermore, a validation study conducted by Pisapia et al. (2011, November) used item analysis, exploratory and confirmatory factor analysis on a data set of 1,117 cases to confirm the constructs posited by Pisapia et al. (2005). The factor analysis confirmed a three-factor solution (reframing – reflecting – systems thinking). Results also indicated good internal reliability and convergent/divergent properties among the subscales.

As the nature of ethnicity changes so does the manner in which people identify themselves. Ethnicity does not seem to be as clear and as definitive a category as just Asian, African-American, Caucasian or Hispanic. Many participants chose “Other” or left the item blank all together, making ethnicity as a moderator difficult to parse. As so many people identify themselves as more than these categories hold, perhaps research on ethnicity is a thing of the past.

Another limitation of this study is that the research was conducted based only on strategic thinking skills. No other forms of thinking skills (i.e. critical thinking) were considered in this research. This decision was made in a conscious effort to determine if skills specific to strategic thinking, reframing, reflection and systems thinking, and or cognitive agility have any ability to be used as a prediction tool in determining undergraduate student academic success.

**Chapter Summary**

This chapter outlines the methodology used to test the research hypotheses. The predictor, moderator, and criterion variables were identified. The instrumentation and process by which data was collected was specified. Additionally, statistical methods used
to analyze and test the data were specified. The results and conclusions are reported in chapters 4 and 5 of this dissertation.
CHAPTER IV.
DATA ANALYSIS

The purpose of this study was to determine how thinking skills possessed by college students prior to university matriculation, high school grade point average (HSGPA), and standardized test scores (SAT) are related to their college grade point average (CGPA), time to degree, and degree earned. This chapter presents the data collected to answer the study’s three research questions and test the two null hypotheses extracted from the conceptual framework.

Study Sample

The sample for this study included two hundred twenty-nine entering freshman at a southeastern university. Table 4 presents the demographic data for the study’s participants.
Table 4

*Descriptive Data for Entering Freshman (n = 229)*

<table>
<thead>
<tr>
<th>Descriptive Variable</th>
<th>Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$n$</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>1</td>
</tr>
<tr>
<td>18</td>
<td>140</td>
</tr>
<tr>
<td>19</td>
<td>81</td>
</tr>
<tr>
<td>20</td>
<td>5</td>
</tr>
<tr>
<td>22</td>
<td>2</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>121</td>
</tr>
<tr>
<td>Male</td>
<td>108</td>
</tr>
<tr>
<td><strong>Ethnicity</strong></td>
<td></td>
</tr>
<tr>
<td>Asian</td>
<td>11</td>
</tr>
<tr>
<td>African-American</td>
<td>31</td>
</tr>
<tr>
<td><strong>Ethnicity</strong></td>
<td></td>
</tr>
<tr>
<td>Hispanic</td>
<td>49</td>
</tr>
<tr>
<td>Caucasian (non-Hispanic)</td>
<td>112</td>
</tr>
<tr>
<td>Not Identified</td>
<td>26</td>
</tr>
<tr>
<td><strong>Education of Mother (EOM)</strong></td>
<td></td>
</tr>
<tr>
<td>No Degree</td>
<td>11</td>
</tr>
<tr>
<td>HS Diploma</td>
<td>72</td>
</tr>
<tr>
<td>Associates</td>
<td>36</td>
</tr>
<tr>
<td>Bachelor’s</td>
<td>64</td>
</tr>
<tr>
<td>Master’s</td>
<td>26</td>
</tr>
<tr>
<td>Specialist</td>
<td>4</td>
</tr>
<tr>
<td>Doctoral</td>
<td>7</td>
</tr>
<tr>
<td>EOM Not Listed</td>
<td>9</td>
</tr>
<tr>
<td><strong>Education of Father (EOF)</strong></td>
<td></td>
</tr>
<tr>
<td>No Degree</td>
<td>17</td>
</tr>
<tr>
<td>HS Diploma</td>
<td>57</td>
</tr>
<tr>
<td>Associates</td>
<td>30</td>
</tr>
<tr>
<td>Bachelor’s</td>
<td>56</td>
</tr>
</tbody>
</table>
Table 4 continued

| Academic Discipline       |    |
|---------------------------|--|--|
| Master’s                  | 32| 14.0|
| Specialist                |  5|  2.2|
| Doctoral                  | 13|  5.7|
| EOF Not Listed            | 19|  8.3|
| **Academic Discipline**   |   |   |
| Arts and Letters          | 24| 10.5|
| Business                  | 36| 15.7|
| Design/Soc Inq            |  8|  3.5|
| Education                 | 13|  5.7|
| Engineering               | 29| 12.7|
| Nursing                   |  8|  3.5|
| Science                   |102| 44.5|
| Not Listed                |  9|  3.9|

Table 4 displays the descriptive nature of the participants. All participants were of typical of freshman year ages. No 21-year-old participants were included in the final data analysis. Both males and females are represented in the data. Ethnicities including Asian, African-American, Hispanic and Caucasian are represented in the sample. Those who identified themselves as “other” or chose to leave this item blank on the survey were listed as “Not Identified”. Education of Mother (EOM) and Education of Father (EOF) ranged from “No Degree” to “Doctoral Degree”. The majority of the subjects had mothers and fathers who earned high school diplomas and bachelor’s degrees. Students, who left this left the item blank, were listed as “Not Identified”. Though their means and standard deviations were calculated, those subjects who responded in this fashion for either ethnicity or parental education were taken out of the moderation analysis later in this chapter, as their results would be difficult to interpret.
Hypotheses Testing

Research Question 1: What Strategic Thinking Skills do Entering Freshman Use?

The first question, “What strategic thinking skills (STS) do entering freshman use?” was answered by reviewing the means and standard deviations of the use of strategic thinking skills. Table 5 provides the means, standard deviations and bivariate correlations of the four scales of the Strategic Thinking Questionnaire (STQ) and their correlations with the criterion variables. Pisapia’s (2009) rule of thumb that usage scores of 4 and higher suggested a strong ability to use the skill, and scores between 3.1 and 3.9 suggested an average ability to use the skill was applied to the data. Scores below 3.1 suggested a weak ability to use the skill.

Table 5

Descriptive Statistics and Correlations of Study Variables

<table>
<thead>
<tr>
<th>Variables</th>
<th>M</th>
<th>SD</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Predictor Variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Reframing</td>
<td>3.80</td>
<td>.87</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Reflecting</td>
<td>4.05</td>
<td>.61</td>
<td>.191**</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Systems Thinking</td>
<td>3.70</td>
<td>.68</td>
<td>.096</td>
<td>.547**</td>
<td>-</td>
<td></td>
<td></td>
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<td>4. Cognitive Agility</td>
<td>3.80</td>
<td>.51</td>
<td>.533**</td>
<td>.817**</td>
<td>.803**</td>
<td>-</td>
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<tr>
<td>5. HSGPA</td>
<td>3.40</td>
<td>.42</td>
<td>.059</td>
<td>.210</td>
<td>.196**</td>
<td>.221**</td>
<td>-</td>
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<td>.13</td>
<td>.079</td>
<td>.040</td>
<td>.244**</td>
<td>.175**</td>
<td>.302**</td>
<td>-</td>
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<td>.206**</td>
<td>.191**</td>
<td>.270**</td>
<td>.434**</td>
<td>.182**</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Time to Degree</td>
<td>.223</td>
<td>.56</td>
<td>.154*</td>
<td>.070</td>
<td>.000</td>
<td>.093</td>
<td>.002</td>
<td>-.024</td>
<td>.170**</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>9. Degree Earned</td>
<td>.445</td>
<td>.73</td>
<td>.157**</td>
<td>.021</td>
<td>-.046</td>
<td>.048</td>
<td>.001</td>
<td>-.007</td>
<td>.211**</td>
<td>.828**</td>
<td>-</td>
</tr>
</tbody>
</table>

Notes: CGPA = College Grade Point Average; HSGPA = High School Grade Point Average; SAT = Scholastic Assessment Test. *p < .05. **p < .01.
Thus, as seen on Table 5, two strategic thinking skills Reframing, \( (M=3.80) \), Systems Thinking \( (M=3.70) \), and overall Cognitive Agility \( (M=3.80) \) fell into the average ability group. However, the Reflecting mean \( (M=4.05) \) suggested a strong ability to use the skill.

**Research Question 2: What are the Relationships among the Use of Strategic Thinking Skills, High School Grade Point Average, Standardized Testing and Undergraduate Academic Success?**

The Second research question, “*What are the relationships among the use of strategic thinking skills (STS), High School Grade Point Average (HSGPA), Standardized Testing (SAT) and undergraduate academic success?*” This was answered by testing the first null hypothesis:

\[ H_0: \text{There were no significant relationships among the use of STS, and HSGPA and SAT scores, in predicting undergraduate student academic success.} \]

Null Hypothesis one was tested in two steps. First a correlational analysis was conducted. The results, found in Table 5, indicate that 20 significant positive correlations, existed between predictor and criterion variables. The criterion variable CGPA was significantly correlated with all of the predictors. These data suggest that participants in this study who used strategic thinking skills more often, had higher college grade point averages than those who used the skills less often. The two other criterion variables, Time to Degree and Degree Earned, had fewer significant correlations with strategic thinking predictor variables. However, participants in this study who used Reframing skills more often, had greater success in obtaining a degree within a timely fashion Time to Degree \( r = .154, N = 229, p < .05 \) and Degree
Earned $r = .157, N = 229, p < .01$. This suggests that students with greater use of reframing skills were somewhat more likely to complete their undergraduate degrees in four years or less.

Another predictor variable, HSGPA was also significantly associated with CGPA. Students who entered college as freshman with higher HSGPA’s, had greater success in maintaining higher CGPA’s, and earning their degree in four years or less. In fact there was a strong association between HSGPA and CGPA $r = .434, N = 223, p < .01$). The sample for this correlation was 224, as 5 students did not have HSGPA in the university archival data source.

Correlations among the predictor variables, suggested that a significant positive relationship existed between Systems Thinking and HSGPA, $r = .196, N = 224, p < .01$ and Systems Thinking and SAT, $r = .244, N = 229, p < .01$. These results suggested that students’ who had a strong use of systems thinking skills had higher HSGPA’s and SAT scores upon entry to the University. Additionally, a significant positive correlation was found between Cognitive Agility and HSGPA, $r = .221, N = 223, p < .01$ and SAT, $r = .175, N = 229, p < .01$, suggesting that higher use of a wider repertoire of strategic thinking skills, specifically systems thinking and cognitive agility was associated with higher HSGPA’s and SAT scores as incoming freshman. Furthermore, a significant positive relationship was found between HSGPA and SAT, $r = .302, N = 223, p < .01$, which suggested that subjects in this sample with higher HSGPA’s had higher SAT scores.

Correlations among the criterion variables indicate that significant positive relationships exist between CGPA, Time to Degree and Degree Earned, suggesting,
that students who maintained higher CGPA’s not only completed their undergraduate degrees, but did so, in four years or less. Null Hypotheses one, was subjected to a second analysis to determine the contribution each predictor variable had in predicting each of the three criterion variables. Table 6 presents the results of multiple regression analysis predicting each of the criterion variables CGPA, Time to Degree, and Degree Earned.

Null hypothesis one, was subjected to a second analysis to determine the contributions each predictor variable had in predicting each of the three criterion variables. Table 6, presents the results of multiple regression analysis predicting each of the criterion variables CGPA, Time to Degree and Degree Earned. As Cognitive Complexity is a simple summation of the other three STS scores (Reframing, Reflecting and Systems Thinking), it was not included in multiple regressions due to its necessary linear dependence with these scores, therefore, it is not represented in Table 6.
A multiple linear regression was performed using each of the predictor and criterion variables. A significant model emerged for CGPA, where \( F(5, 217) = 12.807, p = .005 \). The Adjusted \( R^2 \) estimate = .210, which suggested that this model accounted for 21\% of the variance in CGPA. Predictor variable, HSGPA (\( \beta = .394, t = 6.152, p = .001 \)), and Reframing (\( \beta = .152, t = 2.486, p = .014 \)) were the strongest predictors in this model. Reflecting, Systems Thinking and SAT were not significant in the model for predicting CGPA. Though Reframing was also a significant predictor of Time to Degree (\( \beta = .141, t = 2.062, p = .040 \)), the Adjusted \( R^2 \) estimate = .005, implies that only .5\% of
the variance in Time to Degree was accounted for by all of the predictors in the model. Reframing was also a significant predictor in Degree Earned ($\beta = .149$, $t = 2.172$, $p = .031$). However, as with Time to Degree, the Adjusted $R^2$ estimate (.005) in Degree Earned, suggested that this model accounted for a very small proportion of the variance.

Based on the data presented in Tables 5 and 6, the first hypothesis that “there are no significant relationships among the use of STS, HSGPA and SAT scores, in predicting undergraduate academic success” was rejected. As a test of the Betas in the multiple regression is the contribution of each variable to the prediction of the criterion in addition to the accuracy afforded by all other variables. Therefore the data reveal that Reframing and HSGPA significant predictors of CGPA. Reframing was significant in predicting Time to Degree, and Degree Earned, although adjusted $R^2$ estimates suggested that the model itself was of little predictive value.

**Research Question 3: Are These Predictor-Criterion Relationships Moderated By Contextual Factors?**

The third research question, *Are these relationships moderated by contextual factors* (i.e., age, gender, ethnicity, parent’s education level, and academic discipline) was answered by testing the second null hypothesis.

$H_0:2$: The relationships of STS, HSGPA, and SAT and undergraduate student academic success are not significantly influenced by moderating contextual factors.

In this analysis, the contextual moderators, which may have impacted the relationship between predictor variables and academic success include: Age, Gender, Ethnicity, Education of Mother (EOM), Education of Father (EOF), and Academic
Discipline. In an effort to minimize issues with multicollinearity, Bowerman and O’Connell, (1990) and Myers (1990) suggest that in the case of ordinal variables, if variance inflation factors (VIF) were greater than 10, the variable should be centered. Therefore VIF’s for ordinal variables were examined prior to analysis. In the cases of Age, Gender, Education of Mother, and Education of Father, the VIF’s exceeded 10 and were therefore centered. Strategic Thinking Skills subscales (Reframing, Reflecting, Systems Thinking and Cognitive Agility) as well as HSGPA and SAT, were also centered prior to analysis as their VIF’s also exceeded 10. Additionally, nominal variables (Ethnicity and Academic Discipline), which are polychotomous in nature, were dummy coded and the product terms of each (predictor variable multiplied by the moderator variable) was created to conduct the moderation analysis. Ordinal moderators, which were centered, are presented in Table 7 and nominal moderators, which were dummy coded, are presented in Table 8.
### Table 7

**Relative Contribution of Moderators (Age, EOM, EOF, and Gender), Predictors (Reflection, Reframing, Systems Thinking, Cognitive Agility, HSGPA, and SAT Score), and Criterion Variables (CGPA, Time to Degree, Degree Earned)** (n = 223) †

<table>
<thead>
<tr>
<th>Moderator Term</th>
<th>CGPA</th>
<th>Time to Degree</th>
<th>Degree Earned</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>β</td>
<td>t(215)</td>
<td>p</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reframing</td>
<td>.079</td>
<td>1.210</td>
<td>.228</td>
</tr>
<tr>
<td>Reflecting</td>
<td>.082</td>
<td>1.211</td>
<td>.227</td>
</tr>
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<td>Systems Thinking</td>
<td>.014</td>
<td>.221</td>
<td>.825</td>
</tr>
<tr>
<td>Cognitive Agility</td>
<td>.054</td>
<td>.824</td>
<td>.411</td>
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<tr>
<td>HSGPA</td>
<td>.029</td>
<td>.464</td>
<td>.643</td>
</tr>
<tr>
<td>SAT</td>
<td>.100</td>
<td>1.486</td>
<td>.139</td>
</tr>
<tr>
<td>Gender</td>
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<td></td>
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</tr>
<tr>
<td>Reframing</td>
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<td>-.886</td>
<td>.376</td>
</tr>
<tr>
<td>Reflecting</td>
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<td>-.383</td>
<td>.702</td>
</tr>
<tr>
<td>Systems Thinking</td>
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<td>-.508</td>
<td>.612</td>
</tr>
<tr>
<td>Cognitive Agility</td>
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<td>.619</td>
</tr>
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<td>HSGPA</td>
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<td>Education of Father</td>
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<tr>
<td>Reflecting</td>
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<td>-.996</td>
<td>.320</td>
</tr>
<tr>
<td>Systems Thinking</td>
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<td>-1.071</td>
<td>.286</td>
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</table>

† n = 223
First, ordinal variables Age, Gender, EOM, and EOF along with predictor variables Reframing, Reflecting, Systems Thinking, HSGPA and SAT scores were regressed with criterion variables, CGPA, Time to Degree and Degree Earned analyses. For each moderator-predictor combination, predicting the criterion from the predictor and moderator and the product of the two. The impending tables then present the tests for those product terms. The results are presented in Table 7 where standardized beta coefficients, $t$-values and $p$-values are reported. Additionally, $R^2$, increment of $R^2_{\text{change}}$ and $F$ are presented to give a measure of the contribution of each moderation to the model.
As seen on Table 7, moderators Age, Gender, Education of Mother or Education of Father had little impact on the prediction of CGPA, Time to Degree or Degree Earned when interacting with STS skills, HSGPA or SAT scores predictors.

To analyze what, if any, impact moderator variables Ethnicity or Academic Discipline had on the relationship between predictor variables Reflecting, Reframing, Systems Thinking, HSGPA and SAT and criterion variables CGPA, Time to Degree, and Degree Earned, each of the moderators were dummy coded and multiplied by the predictor variable to create a product term. Once product terms were created for each variable and moderator, multiple regression analysis was conducted using the aforementioned product terms. After creating the product terms and regressing the criterion on the predictor, dummy codes, and the products of the dummy codes and the predictor, the contribution of those product terms to predication accuracy was tested. If in fact a significant relationship did exist, simple correlations were calculated for each level of the moderator. For all moderations, the *Sum of Squares, Mean Square, p values* and $R^2_{\text{Change}}$ were reported in Table 8. The $R^2_{\text{Change}}$ was the proportion of variance accounted for by these moderation terms and provided the effect size (discussed in Chapter 5). Cohen’s (1988), philosophy for effect size for $R^2$, (which is a proportion of two positive numbers) has a minimum of 0 and a maximum of 1 (Aron & Aron, 1999). Cohen’s (1988) effect size $R^2$ are .01 = small; .06 = medium and .14 = large.
Table 8

Relative Contribution of Moderators (Ethnicity and Academic Discipline), Predictors (Reflection, Reframing, Systems Thinking, HSGPA, and SAT Score), and Criterion Variables (CGPA, Time to Degree, Degree Earned) \((N = 223; F (df4, df7))\).

<table>
<thead>
<tr>
<th>Moderator Term</th>
<th>CGPA (SSq)</th>
<th>(Mean) (Sq)</th>
<th>(p)</th>
<th>(R^2) (Change)</th>
<th>Time to Degree (SSq)</th>
<th>(Mean) (Sq)</th>
<th>(p)</th>
<th>(R^2) (Change)</th>
<th>Degree Earned (SSq)</th>
<th>(Mean) (Sq)</th>
<th>(p)</th>
<th>(R^2) (Change)</th>
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<tr>
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<td>.548</td>
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<td>.008</td>
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<td>.238</td>
<td>.059</td>
<td>.980</td>
<td>.002</td>
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<tr>
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<td>.017</td>
<td>1.475</td>
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<td>.901</td>
<td>.012</td>
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</table>

\*p < .05
Table 8 presents moderation data for Ethnicity and Academic Discipline. A significant relationship was found \((p = .00)\), where Ethnicity influenced the relationship between HSGPA and CGPA. Though a significant relationship was found, this data was difficult to disaggregate as many students opted to define himself or herself as “Other” or “Not Identified”. Therefore any analysis of this variable beyond the multiple regressions was difficult to parse and was left out of subsequent discussion.

A significant relationship was also found \((p = .024)\), where Academic Discipline moderated the relationship between Reflecting skills and Degree Earned. Upon further review of this finding (review of multiple regression analysis), the data revealed that the College of Arts and Letters had a \(\beta = .232, t = 3.320, p = .001\), while other colleges had no significant relationships. This finding may suggest that perhaps students with higher use of Reflecting skills are attracted to the College of Arts and Letters’ programs. The data also suggested that students coming into the University with higher Reflecting skills who attend the College of Arts and Letters complete their degree more often that students without such skills.

Based on this data, hypothesis two: The relationships of STS, HSGPA, and SAT and undergraduate student academic success were not significantly influenced by moderating contextual factors was not confirmed as Ethnicity moderates the relationship between HSGPA and CGPA. Academic Discipline moderates the relationship between predictor variable Reflecting and criterion variable, Degree Earned.

**Chapter Summary**

The purpose of this study was to determine how thinking skills possessed by college students prior to university matriculation, HSGPA and scores on the SAT are
related to their CGPA, Time to Degree, and Degree Earned. Both descriptive and inferential statistics were used to report the findings. Descriptive statistics were used to describe the participants and their contextual information. Inferential statistics were used to answer three research questions and to test the two null hypotheses. The data presented in this chapter showed that there were significant correlations between predictor and criterion variables. Multiple regressions are the increment to prediction accuracy afforded by the variable in addition to that available from all other variables that were tested. Predictors, Reframing and HSGPA predicted criterion variable CGPA. Reframing predicted criterion variables Time to Degree and Degree Earned. Academic Discipline moderated the relationship between Reflecting and Degree Earned.

A summary of the results of these tests is reported in Table 9 Summary of Hypothesis testing. Additionally, Table 10 provides a summary of correlations that reached the substantial practical significance level. Discussion of these results recommendations for future research and conclusions are presented in Chapter V.

The findings of this research study are presented in Tables 9 and 10 and discussed in Chapter 5.

Table 9

Summary of Hypothesis Testing

<table>
<thead>
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<th>Null Hypothesis</th>
<th>Status</th>
</tr>
</thead>
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<tr>
<td>1. There are no significant relationships among the use of STS, HSGPA and SAT scores, in predicting undergraduate student academic success.</td>
<td>Reject</td>
</tr>
<tr>
<td>2. The relationships of STS, HSGPA, and SAT and undergraduate student academic success are not significantly influenced by moderating contextual factors.</td>
<td>Reject</td>
</tr>
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</table>
### Table 10

**Summary of Correlations and Multiple Regressions Reaching the Substantial Practical Significance Level**

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Correlation</th>
<th>$f^2$ Effect Size</th>
<th>Practical Significance Category</th>
</tr>
</thead>
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<tr>
<td>H$_01$ HSGPA &amp; Systems Thinking</td>
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<td>Small</td>
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<tr>
<td>HSGPA &amp; Cognitive Agility</td>
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<td>Small</td>
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<tr>
<td>SAT &amp; Systems Thinking</td>
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<td>Small</td>
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<tr>
<td>SAT &amp; Cognitive Agility</td>
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<td>SAT &amp; HSGPA</td>
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<td>SAT &amp; CGPA</td>
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<td>Small</td>
</tr>
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<td>Reframing &amp; Time to Degree</td>
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*Note: Cohen’s (1988) effect size $f^2$ are .02 = small; .15 = medium, .35 = large; effect size for correlation $r = .1 =$ small, .3 = medium, .5 = large*
CHAPTER V.

FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

Restatement of the Problem

Empirical studies and researchers have argued which measures best predict student academic success in higher education. Reviewing the literature posed in Chapter II, from this debate, several streams of research emerged. One research stream argued that a student’s ability to be successful was best predicted by his/her high school grade point average (HSGPA), (Atkinson & Geiser, 2009; DeBerard et al., 2004; Geiser & Santelices, 2007; Geiser & Studley, 2004; Hall, 2001; Hall et al., 2008; Lotkowski et al., 2004; Stupinsky et al., 2007). A second stream of research suggested that standardized test scores, such as the Scholastic Assessment Test (SAT) and the American College Test (ACT) are the best predictors of a student’s ability to be successful in college (Astin, 1993; Schmitt, et al., 2009; Sparkman et al., 2012; Sternberg, 2010). Another stream of research suggested that a student’s ability to think was the best predictor of success (APA, 1993, 1997 as cited in Zins et al., 2004; Stupinsky, et al., 2008). Finally, a fourth stream of research claimed that alternative measures, such as creativity, motivation, persistence, academic goals, emotional intelligence and other non-cognitive measures were viable predictors of student academic success (Astin, 1993; Beck & Davidson, 2001; DeBerard et al., 2004; Parker & Duffy 2005; Parker et al., 2005; Sparkman et al., 2012).

Though each of these areas of research, all of which are based on empirical
studies, are viable options and measurements for college admissions, the ability to predict college success beyond the freshman year is limited within the literature (Harackiewicz et al., 2002). Through a longitudinal study, this current research addressed the gap in that literature by focusing on academic success beyond the freshman year toward the attainment of an undergraduate degree.

**Review of the Purpose of the Study**

The purpose of this study was to determine how thinking skills used by college students prior to university matriculation, high school grade point average (HSGPA), and standardized test scores (SAT) are related to their college grade point average (CGPA), Time to Degree, and Degree Earned. Specifically, this study sought to answer two important questions: (a) what strategic thinking skills (STS) do college students poses prior to university matriculation and (b) how do the students’ use of these skills compare to HSGPA and (SAT) in predicting academic success? The following three sub-questions guided the study’s research design, data collection, and data analysis:

1. What strategic thinking skills (STS) do entering freshman possess?
2. What is the relative contribution of each predictor variable to academic success variables?
3. Are these relationships moderated by contextual factors?

**Review of the Procedures**

This study gathered data from 229 first semester freshmen at a Regional University in South Florida (N = 229). First semester freshman were chosen specifically in order to mitigate the effect that university life may have on their academic data. Data
gathered included a 50-item survey the Strategic Thinking Questionnaire (STQ), which was completed in person and university archival sources.

The data was collected following the procedures that were outlined in Chapter III of this study. The procedures consisted of three phases. Phase I included the dissemination of the STQ during the Fall 2009 academic year. Participants were advised as to the nature of the study and the confidentially requirements thereof. Phase II, data was collected on the moderator and criterion variables through archival data sources, during the summer of 2013 and fall 2014 semesters. Information gathered from the University archival data system regarding participant’s high school grade point average, standardized test scores, as well as cumulative grade point average and enrollment status for each participant was obtained at this time. Additionally graduation information was obtained and reviewed at this time. Students who did not enroll for more than three consecutive semesters were eliminated from the data pool. Phase III included scoring the STQ and analyzing the data using SPSS. After the data cleaning process (the omitting of surveys which were for any reason incomplete, answers were inconsistent, or students who were no longer enrolled) descriptive statistics, including means and standard deviations were analyzed, as well as correlational analysis and multiple regression analysis.

**Summary of Findings**

The eight major findings of this study are presented in Table 11.
Table 11

**Major Research Findings**

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<td><strong>Finding 7</strong></td>
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<td><strong>Finding 8</strong></td>
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</table>

These findings are discussed in the following paragraphs.

*Finding 1* - First semester undergraduate students used an average to above average ability to use strategic thinking skills (Reframing, Reflecting, Systems Thinking and Cognitive Agility).

First semester undergraduate college students do use strategic thinking skills. The means and standard deviations afford practitioners to interpret this finding as significant. This finding reveals that students are graduating high school and coming into the university system with the ability to use reframing, reflecting, systems thinking and cognitive agility. This finding should encourage practitioners at both the collegiate level
and within the K-12 system. These central skills can be learned and implemented as well as integrated into the curriculum in our nation’s schools. For colleges and universities, this finding can give admissions offices additional tools by which they can determine student’s potential for long-term academic success. The significance and implications of strategic thinking skills and alternative methods for admissions is supported by previous research. Research by Boon (2001), Eaton and Lawrence, (1999), Graetz (2002), Liedtka (1998), Mintzberg (1994), Pang and Pisapia (2007, 2012), Pisapia (2009) and Pisapia et al. (2005), each agree that the ability to think within a strategic mind-frame, which incorporates the ability to be creative, anticipate what may happen next and use previous knowledge and experience in combination with each other in order to achieve a new and perhaps more desirable outcomes, such as academic success. Though strategic thinking is an organizational term, in order for it to be achieved and for the individuals within the organization to develop these skills, organizations such as K-12 schools and institutions of higher learning must actively choose to provide a space and atmosphere for these ideas and frameworks to take hold. Organizations must provide supporting contexts for strategic thinking skills to be used successfully (Boon, 2001; Eaton & Lawrence, 1999; Liedtka, 1998), perhaps then it can become a sustainable part of educating and evaluating students in the years to come.

Finding 2 - There were significant positive correlations among the use of strategic thinking skills (Systems Thinking and Cognitive Agility) and HSGPA and SAT.

As Systems Thinking and Cognitive Agility increased, so did HSGPA. This finding revealed a small effect size. Even though the effect size was small, this finding still allows practitioners to infer the results as having a reasonable amount of practical
significance. This relationship is supported within the literature. A growing field of research, in education and psychology, suggests different approaches to evaluation that may allow for broader and more inclusive review of individual talents. The theory of multiple intelligences, for instance, suggests, “human cognitive competence is better described in terms of a set of abilities, talents, or mental skills” called “intelligences” (Gardner, 2006 as cited in NACAC, 2008, p. 18).

Alternative measures such as emotional intelligence and control (Robbins et al., 2006) as well as other cognitive variables such as self-regulation, self-awareness and critical thinking skills, add additional and often valuable information on what may lead students to achieve academic success (DeBerard et al., 2004; Lotkowski et al., 2004; Shapiro & Livingston, 2000).

The relationships found in this research study, which was longitudinal, may provide colleges and universities with the ability to admit students who can achieve long-term academic success. Tools that can give a more precise picture of students’ capabilities beyond first year grades may be a welcome addition, especially for schools with high attrition rates.

Finding 3 - There were significant positive correlations between STS skills Reframing, Reflecting, Systems Thinking, Cognitive Agility, HSGPA, and SAT scores, and CGPA.

The criterion variable CGPA had the largest number of significant correlations, with predictor variables. These findings suggest that as STS skills, HSGPA and SAT increase, so does CGPA. STS skills and SAT revealed small effect sizes. Traditional predictor variable HSGPA revealed a medium effect size. These effect sizes have practical significance, which may afford practitioners in admissions
the ability to consider additional predictor variables such as Reframing, Reflecting, Systems Thinking, and Cognitive Agility as viable predictors of academic success over the long term to a degree earned. These findings are supported by the literature, Harackiewicz et al. (2002) states that a longitudinal study in this area could offer “analysis of the short and long-term effects of goals relative to other potential predictors (p. 563). Geiser (2007) suggests that college or “cumulative grade point average, like HSGPA is based on repeated sampling of student performance over time in a variety of academic settings, CGPA in the fourth year of college tends to be less variable and possibly a more reliable indicator of students’ true ability and achievement than their first year grades” (Geiser, 2007, p. 17).

Finding 4 - There was a significant positive correlation between STS skill (Reframing) and Time to Degree.

Time to Degree showed a significant positive correlation with strategic thinking skill Reframing. This finding had a small effect size and is of practical significance. For practitioners, this finding suggests that by guiding students through the act of reframing and helping them to understand and navigate what it means to reframe a situation, the shorter time it may take them to earn their undergraduate degrees. This finding is supported by the research of Bolman and Deal (2003, 2008) who suggests that, “the ability to reframe experiences enriches and broadens a leader’s repertoire and serves as a powerful anti-dote to self-entrapment” (p. 4). Failure to recognize new methods and problem solving models can lead to the demise of any organization, even an academic career. Reframing is a cognitive function, one that can be taught and a skill that an individual can become quite adept at using. If institutions can provide the skills and
experiences necessary for to engage in reframing as they are constantly faced with challenges the more power a student will have over their academic career.

**Finding 5** - There was a significant positive correlation between Reframing and Degree Earned.

Degree Earned showed a significant correlation with strategic thinking skill Reframing. The effect size was small and has practical significance. This finding, though small suggests that those students who effectively utilize reframing skills, persist and go on to complete their undergraduate degree. This finding should suggest to practitioners that the use of reframing could be an essential skill, when trying to achieve degree completion. This finding is supported by past research as the majority of the empirical studies on academic success using HSGPA and standardized test scores rarely goes beyond predicting freshman year grades. Few studies establish a link between HSGPA and standardized tests and their ability to predict college graduation (Hall et al., 2008; Schuh, 1999; Scott et al., 2006). “While HSGPA and standardized test scores have been shown to be the best predictors of college success, (during freshman year) recent research demonstrates that HSGPA and SAT scores are unrelated to the prediction of college graduation” (Schuh, 1999, p. 642 as cited in Sparkman et al., 2012). Additional research on a longitudinal scale into the effects of using reframing skills would perhaps further support these research claims as well. As of yet, empirical research conducted over the course of several years, is limited.

**Finding 6** – There were significant relationship found between STS skill (Reframing) and the prediction of CGPA, Time to Degree, and Degree Earned.
The predictor variable Reframing was found through multiple regression analysis to predict CGPA, Time to degree and Degree Earned. The results from the tests of the Betas tells us that each predictor contributes significantly to the model given the variance predicted by all other variables in the model. The effect size for CGPA was medium but for Time to Degree and Degree Earned it was small. These relationships are of practical significance.

These findings confirm that the use of strategic thinking skill Reframing can provide practitioners such as admissions officers with a broader picture of the likelihood of academic success beyond the typical freshman year studies. These finding suggest that STS skill Reframing can be an important component of predicting the long-term academic success of undergraduate students. Perhaps teaching these skills prior to freshman year of college would prove advantageous to students by learning the skills during their K-12 academic experiences. This could lead to a need for the nations K-12 system to integrate strategic thinking skills into everyday curriculum and experiences. This finding is supported by the literature of Bolman and Deal (2003, 2008) who refer to a frame as a lens. This lens allows individuals different ways in which to view and make sense of their world and reality. Pisapia et al. (2005) suggests that reframing is the ability of one to weave logical and rational thinking through the use of perceptions, experience and information in order to make judgments on what has occurred. Additionally reframing is the eventual creation of intuition, which guide future actions and decision-making processes.

*Finding 7*- High school grade point average is a predictor of College grade point average.
Predictor variable HSGPA predicts long-term CGPA. The results from the tests of the Betas tells us that each predictor contributes significantly to the model given the variance predicted by all other variables in the model. The effect size was medium and this relationship is of practical significance. This finding confirms the use of HSGPA as a good tool for institutions in predicting student performance. For practitioners, HSGPA continues to be the most reliable predictor of not just freshman year performance but performance over the longer term. This finding is wildly supported in research literature. There are hundreds of empirical studies which cite HSGPA as the single best predictor of college success (Atkinson & Geiser, 2009; Geiser & Stanciles, 2007; Geiser & Studley, 2004; Hall et al., 2002; Sternberg, 2010; Stupinsky et al., 2007; Zins et al., 2004).

Finding 8 - There were significant relationships found between STS skill (Reflecting), Degree Earned and Academic Discipline.

A significant relationship was found with the contextual variable Academic Discipline. Academic Discipline impacted the relationship between Reflecting and Degree Earned. The effect size was small and it was of practical significance. Research into each level of the moderator relationship, revealed Reflecting skills and Degree Earned was not the same across all disciplines, in that a significant relationship was found only in the College of Arts and Letters but in no other college. This finding suggests that perhaps students who had a high use of STS skill Reflecting were drawn to the colleges and degree programs that make use of this skill in their curriculum and experiential learning processes. For practitioners, these findings on the use of reflecting, is supported by the research of King and Kitchner’s (1994), ten-year longitudinal
research on Reflective Judgment. This study found that the ability to learn and use reflective judgment hit its peak during the later years of high school through well into the college years. Additionally, Pisapia (2009) asserts that, “reflection is a cognitive skill that involves careful consideration of any belief or practice that promotes understanding of situations and then applies the newly gained knowledge to these situations” (p. 91).

Reflection is a skill, a skill that can and should be taught in order for individuals to gain insight and perspective on past behaviors and performance. If used to its fullest potential, the art of reflection can change the manner in which information is processed and judgments are made, which in turn can guide future actions (King & Kitchner, 1994; Lynch & Wolcott, 2001; Pisapia, 2009). As the College of Arts and Letters revealed this significant relationship, further research into program offerings may provide and insight if these programs and the professors who teach them, are using reflective skills in their classrooms, through experiential learning processes or in texts, can be discovered.

Conclusions

Drawing definitive conclusions from this research may be premature. However based on the data presented in this study, it can be concluded that student students with greater cognitive agility had higher high school and college grade point averages. These data highlight the importance of utilizing additional thinking skills to traditional predictors of academic success and college entrance standards because higher CGPAs were linked to shorter Time to Degree and Degree Earned in this study. These students completed their degree in a timely manner.

The association between cognitive agility, grade point averages and college success is an important link that needs to be substantiated in further studies. If the
finding holds up then it has important consequences for redefining high school and early college curricula. These skills are not only valuable to the academic success in earning a higher grade point average or completing a degree in a timely fashion, but eventually they are skills essential to life success.

**Recommendations for Practitioners**

One of the unstated assumptions of this study was to explore alternative methods for predicting the eventual academic success of first semester freshman, (beyond their first year as most research has already done) up until graduation. This study revealed several significant relationships with regard to predictors Reframing, Reflecting, Systems Thinking and Cognitive Agility. From this research it could be conceived that additional and alternative tools for admissions may be valuable. While traditional measures such as HSGPA were predictive and a valued tool for colleges and universities and the challenges this country faces in this next century, we should demand individuals be able to think more critically, more reflectively and more synthetically and creatively.

The ability to think in these ways is the real goal of a college education. For example, the American Psychological Association’s (APA) report, which suggested, “The successful learner can create and use a repertoire of thinking and reasoning strategies to achieve complex learning goals” (APA, 1993, 1997 as cited in Zins et al., 2004, pp. 29-30), supports this body of research. Yet, information regarding these factors which may contribute to student’s capacity to use and develop the ability to think in a critical, synthetic, and creative manner and the implications of that knowledge on academic success are scarce (Stupinsky et al., 2008). Therefore, utilizing measures other
than just the traditional HSGPA and standardized test scores could be an essential tool in admitting students who are capable of not only academic success, but also becoming successful contributors to the advancement of our nation. Epstein (2009) provides support for this claim, as his research cited William Hiss of Bates College, who suggested that low standardized test scores suggest that “student cannot do good work, when in fact the can” (p. 12). Our colleges and universities must not turn away potential students with the desire to broaden their minds and experiences because they do not test well. Perhaps their gifts lie in other more non-traditional areas such as creativity, empathy, adaptability, mindfulness and perseverance. Furthermore, as strategic thinking skills have shown to be important in this study, the need to integrate these skills into the K-12 curriculum may be just as important as the teaching of analytical reasoning and critical thinking skills.

Practitioners including classroom teachers in K-12, college professors, administrators can provide students with learning experiences which include the art of reframing, reflecting and systems thinking by working with students both in the classroom and individually. For example, Amundson (1996) suggests that various types of counselors often use reframing techniques to facilitate change in student’s perceptions and attitudes. This can be accomplished by looking at students’ previous achievements and accomplishments while looking at present negative thought patterns, and using this to and look ahead and discover possible hypothetical solutions. By providing this type of experience to students, educators can open up a whole new paradigm for students to build future successes on.

In teaching reflective skills, educators may want to encourage students to ponder questions more carefully, spend more time thinking of outcomes before giving a solution
or answer to a problem. Reflection requires questioning; therefore educators must provide opportunities for students to ask more questions, questions that are intricate and thoughtful. If we want students to be engaged in reflective thought, there needs to be dedicated time during the class for it to occur. Lecturing for an entire class or during a subject does not provide students with the ability or time to engage in reflection. Giving students the opportunity to learn these along with critical thinking is crucial in their ability to grow, develop and become successful.

**Recommendations for Future Research**

Research on alternative admissions tools and the importance of critical thinking and judgment has been investigated for decades. However, this research was the first to look at the relationship of integrative thinking skills and our conclusions demonstrate the importance of this finding. Still this is one study. The findings require replication.

Researches on what variables can predict academic success in college have also been examined for decades. However this research is mainly focused on freshman year success. Where there is a gap in the research was how these predictor variables contribute to the prediction over the long term. Does HSGPA and standardized testing have predictive validity beyond the freshman year? Few if any studies go beyond reviewing what leads to academic success after the first year of college. Though this research is important, the educational community needs research on what predictors are viable for long-term success. Again this study provided the impetus to continue to look for long-term predictors. These findings can help institutions select students who will not only graduate, thereby increasing retention
and the funding that goes along with it, but admissions offices may be able to go
further than that, into - does long term predication lead to alumni giving and
involvement after a degree has been awarded.

Future research should include greater numbers of students, perhaps an entire
freshman class as part of their entrance requirements could take the STQ and
appropriate studies could be developed to refute or confirm the findings in this study.
Evaluating these students and their strategic thinking abilities could provide
institutions with valuable information. For example, tracking a freshman class from
commencement to graduation could reveal a tremendous amount of information with
regard what skills and abilities moved these students to complete degrees. If this
research is conducted and similar results are found, perhaps bringing these important
skills into the K-12 system would be in beneficial. What if we as a society moved
away from testing and into teaching our students the skills that will really be essential
to both academic and life success?

Limitations

The following are limitations of this research and should be considered prior to
drawing inferences from the results.

1. The sample size was small given the size of the university.
2. Only one campus was evaluated. This regional university has three other
campuses from which subjects could be sampled.
3. The demographic data collected was unclear on the questionnaire and
should be reevaluated prior to additional dissemination.
4. Ethnicity and the manner in which people classify themselves had vastly changed from prior research. Therefore, ethnicity has become a difficult contextual variable to parse and therefore evaluate.

5. This research does not take into account issues of adversity that may have affected students who participated in this study.
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Note. Adapted from U.S. Department of Education, National Center for Education Statistics.
Appendix B: Concordance Table for SAT and ACT

Table 13

SAT/ACT Concordance Tables

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<th>SAT CR-M (Score Range)</th>
<th>ACT Composite Score</th>
<th>SAT CR-M (Single Score)</th>
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<td>1360-1390</td>
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<td>1380</td>
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<td>1190</td>
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<td>720-760</td>
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<td>560-610</td>
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<td>510-550</td>
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<th>SAT Writing (Score Range)</th>
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<th>SAT Writing (Single Score)</th>
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<td>770-790</td>
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<td>300-310</td>
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</table>

Note. Adapted from “College Board: Office of Research and Development RN-40,” 2009.
Appendix C: Institutional Review Board (IRB) Letter of Approval

INSTITUTIONAL REVIEW BOARD (IRB)

PROTOCOL APPLICATION FOR RESEARCH INVOLVING HUMAN SUBJECTS

Office Use Only:
Protocol # ________________
Reviewer Risk Assessment: __________________________
Category Determination: ____________________________

Submit 16 copies of this application (if filing for Category C review) or 4 copies (if filing for Categories A or B review) to:
Office of Sponsored Research
Office of Research Subjects Protections – ADM 239
777 Glades Road, Boca Raton, FL 33431
Please contact the office at 7-0777 if you have any questions. This application must be typed or it will be returned.

SECTION I: TYPE OF RESEARCH (Refer to Attached Appendix I)

☐ Category A: □ A(1) □ A(2) □ A(3) □ A(4) □ A(5)

☐ Category B: □ B(1) □ B(2) □ B(3) □ B(4) □ B(5) □ B(6) □ B(7) □ B(8) □ B(9)

☐ Category C: Neither category A or B apply.

SECTION II:

1. Responsible Project Investigator (RPI)
(If this is a student thesis or dissertation, the RPI should be the Thesis Committee Chair)

RPI Name: John Pisapia

Appt. Type: ☑ Faculty ☐ Staff ☐ Other
(Note: If other, please state title and attach copy of FAU appointment letter.)

Mailing Address: Florida Atlantic University, R, 251, Bldg. #47 Boca Campus

Telephone: 73556 E-mail Address: jpisapia@fau.edu

Approved 9/8/06; Updated 11/1/06
REFERENCES

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