

PREDICTING HIGH SCHOOL GPA USING HEXACO PERSONALITY DOMAINS AND  
THE SECONDARY SCHOOL ADMISSION TEST

By

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Liberty University

A Dissertation Presented in Partial Fulfillment

Of the Requirements for the Degree

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## ABSTRACT

Predictive studies of non-cognitive personality traits and SAT on college GPA are well established, but far less is known about the association between personality traits and comparable secondary school admission tests on secondary school GPA. This study assessed the relationship between the personality domains in the HEXACO: Personality Inventory-Revised (HEXACO: PI-R) inventory and secondary school GPA, while controlling for performance on the Secondary School Admission Test (SSAT). The results of the hierarchical regression analysis demonstrated no association between the HEXACO domains and GPA and a significant association between SSAT and GPA. The use of the personality domains in the HEXACO: PI-R inventory does not significantly add to prediction of high school GPA, while the SSAT is a strong predictor of academic success in a secondary school population, accounting for approximately 31% of the variance.

*Keywords:* HEXACO, SSAT, high school GPA, predict academic success

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### **List of Abbreviations**

Grade Point Average (GPA)

Graduate Management Aptitude Test (GMAT)

National Association of College Admission Counseling (NACAC)

National Association of Independent Schools (NAIS)

National Collegiate Athletic Association (NCAA)

National Council for Educational Statistics (NCES)

Non-Cognitive Questionnaire (NCQ)

Secondary School Admission Test (SSAT)

Secondary School Admission Testing Board (SSATB)

Sternberg Triarchic Abilities Test (STAT)

Wisdom, Intelligence and Creativity, Synthesized (WICS)

Western Interstate Commission for Higher Education (WICHE)

## CHAPTER ONE: INTRODUCTION

Selective colleges and universities in the United States employ various admission techniques to choose an incoming class of students. Standardized testing, most often the SAT, formerly known as the Scholastic Aptitude Test (College Board, 2008), or the ACT, formerly known as the American College Testing college readiness assessment (ACT, 2008), is one of the two most frequently used criteria for admission and often carries the most weight (National Association of College Admissions Counselors [NACAC], 2015). SAT scores are commonly used nationally as they have been shown to predict grade point average (GPA) (Burton & Ramist, 2001; Camara & Echternacht, 2000; Geiser & Santelices, 2007; Kobrin, Patterson, Shaw, Mattern, & Barbuti, 2008) and indicate college success. In the same way that colleges use SAT scores to make admission decisions, independent secondary education has adopted the Secondary School Admission Test (SSAT) scores (Secondary School Admission Testing Board [SSATB], 2010) as a companion to intermediate GPA in their admission processes. As a result, admission to selective independent secondary schools and the SSAT bears a similar relationship to college admission and the SAT, with these factors determining admittance and financial access at the secondary school level.

Research on standardized tests such as the SAT or ACT at the college level, however, has shown mixed effectiveness in predicting academic success. Some research has suggested that the predictive ability of those tests may be overstated (Burton & Ramist, 2001) or gender-biased (Leonard & Jiang, 1999; McGraw, Lubinski, & Strutchens, 2006; Wainer & Steinberg, 1992). Other research suggests standardized tests under-predict the academic performance of certain racial and ethnic groups (Crouse & Trusheim, 1988; Keiser, Sackett, Kuncel, & Brothen, 2015;

Kling, Nofle, & Robins, 2012; Ting, 1998; Ramist, Lewis & McCamley-Jenkins, 1994; Shaw, Kobrin, Patterson, & Mattern, 2012). These questions have led educators and admission professionals to seek other modes of selection different from psychometric testing to support higher education opportunities across the full range of the college-bound population (National Center for Public Policy and Higher Education, 2010), including the use of non-cognitive variables such as are found in personality traits, behaviors or individual attributes different from traditional assessments of intelligence. This research includes the use of non-cognitive variables measuring self-concept (Gigliotti & Gigliotti, 1998; Mattson, 2007), creativity (Sternberg et al., 2010), alternate classifications of intelligence (Sternberg, 1999, 2003) or personality traits such as the HEXACO Personality Inventory Revised (HEXACO: PI-R) (Lee & Ashton, 2004).

Research on alternate modes of admission and selection at the college level is relatively extensive, yet little related research has been conducted on secondary school education admission factors even though a similar relationship to educational opportunity, financial aid, and institutional access exists. This chapter details the history and background of traditional standardized testing as a method for predicting academic success, describes the research and historical framework for the inclusion of non-cognitive measurements as predictors, and examines the rationale for research into alternative forms of assessment such as the HEXACO: PI-R personality inventory (Lee & Ashton, 2004) on selective secondary school admission practice.

### **Background**

Selective educational institutions in the United States currently employ a wide range of quantitative measures and secondary qualitative factors to evaluate potential candidates as part of the admission selection process. National standardized examinations such as the SAT and the

ACT have become part of these selection factors to account for potential differences in grading scales and variation in rigor among secondary schools (NACAC, 2015). The main challenge for post-secondary admission offices and senior enrollment administrators is to weigh objective factors such as standardized testing equitably with any other subjective factors as they select their incoming undergraduates.

Historically, the most prevalent mode of predicting student academic performance in college has been standardized tests such as the SAT or ACT (Breland, Maxey, Gernand, Cumming, & Trapani, 2002), with these tests used concurrently with a student's high school GPA (NACAC, 2015). Almost 90% of colleges and universities cite the SAT as having "considerable" or "moderate" importance in their admission policies, and both public and private post-secondary institutions use the SAT as a factor in determining merit-based financial aid (NACAC, 2015). If the SAT plays a significant factor in gaining admission and receiving scholarship aid, students and families thus have a reasonable expectation the measurement is valid. Large-scale research has been conducted showing the SAT as having moderate predictive validity on performance (Burton & Ramist, 2001), where the average correlation of .39 was found across 45 colleges. The SAT has also been found to have no additional predictive ability over the use of class rank, a measure derived from high school GPA (Baron & Norman, 1992; Niu & Tienda, 2012; Warne, Nagaishi, Slade, Hermesmeier, & Peck, 2014; Zwick, 2013). Similar research posits that the SAT under-predicts the performance of women (Keiser et al., 2015; Leonard & Jiang, 1999; Rosner, 2012; Wynne, 2006) and certain ethnic groups (Aguinis, Culpepper & Pierce, 2016; Shaw et al., 2012; Young, 2003), with results suggesting the under-prediction could be due to inherent test bias (Jencks & Phillips, 1998; Soares, 2011).

Institutions of higher learning have faced additional challenges in the last 50 years related to admission and financial aid practices given the demographic changes in the college-bound population (Kinzie et al., 2004). The total size of the college-bound population in the United States has increased dramatically since the creation of the Educational Testing Service in 1948, while the composition of the college-bound cohort has increased and diversified both racially and socio-economically (NACAC, 2015; National Center on Educational Statistics [NCES], 2015). As the characteristics of college-aged students has widened and diversified, many post-secondary institutions, individual researchers, and other interested constituents of higher education have examined the traditional selection metrics to determine whether they accurately predict student academic success in light of these demographic changes (Mattern et al., 2008; Ramist et al., 1994; Geiser & Studley, 2001; Young, 2003). Research in this area has produced mixed results, with some studies suggesting standardized testing may not be an accurate predictor of academic achievement in racially or socio-economically diverse populations (Aguinis et al., 2016; Crouse & Trusheim, 1988; Ramist et al., 1994; Shaw et al., 2012; Ting, 1998). The college-bound cohort has changed sharply as well in the last few decades with a growing percentage of attendance and degree completion from female students (Bailey & Dynarski, 2011), with research similarly showing standardized testing under-predicting the academic performance of women (Fischer, Schult, & Hell, 2013a; Leonard & Jiang, 1999; McGraw et al., 2006; Rosner, 2012; Wainer & Steinberg, 1992).

Secondary schools utilizing selective admission have experienced similar demographic changes in the recent decades. The percentage of female students enrolled has steadily increased across the country (NCES, 2010), while the percentage of enrolled non-white students in high schools has grown at an expanding rate (Western Interstate Commission on Higher Education,

2012). As selective secondary schools seek to increase diversity (National Association of Independent Schools [NAIS], 2003) and admission policy incorporates the demographic changes in ethnicity and gender, selective high schools face similar pressure to use effective selection methods just as their college counterparts. Although the SSAT stands as a dominant selection factor in secondary school admission (SSATB, 2010), little research has been conducted on the predictive ability of the test for high school populations, including examinations of potential differences across race or gender. Research into non-cognitive variables of student success such as self-concept, perseverance and passion for goals or openness to experience have shown to have useful predictive validity in college and university admission practice (Conard, 2006; de Vries & de Vries, 2010; Duckworth and Seligman, 2006a), indicating further research into non-cognitive variables in high school populations may advance equity of access and stronger prediction models in secondary school admission procedures.

### **Non-Cognitive Measurements for Predicting Academic Performance**

Non-cognitive measurements have been used considerably less widely and far less frequently in contrast to measurement tools such as nationally normed standardized tests. Non-cognitive measurement tools such as the Non-Cognitive Questionnaire (Tracey & Sedlacek, 1984), the grit scale (Duckworth, Peterson, Matthews, & Kelly, 2007) or the Rainbow Project (Sternberg et al., 2010) have been used to examine the relationship between certain individual dispositions and academic success, with the results suggesting that personality traits such as perseverance, creativity or self-concept may be factors predicting student achievement. Self-discipline has shown to predict academic success beyond standardized tests, especially in girls (Duckworth, 2006b).

Creativity also has been examined as a potential predictor of performance beyond the SAT (Sternberg et al., 2010) in research using an alternate definition of intelligence than standardized testing traditionally measures (Sternberg, 2003). Research into perseverance and passion for long-term goals has shown to predict academic achievement in military academy cadets and for participants in the Scripps National Spelling Bee (Duckworth et al., 2007), while other personality constructs such as self-concept (Conard, 2006; Gerardi, 2005) have shown predictive ability for academic performance in the classroom for both traditional and non-traditional students. Personality traits within the Big Five personality constructs (O'Connor & Paunonen, 2007) such as Conscientiousness or Openness to Experience have shown to be effective predicting academic success as measured on college GPA. Studies of non-cognitive variables of student success have shown useful predictive validity in higher education (Duckworth et al., 2007; Nofle & Robins, 2007; Sternberg, et al., 2010; Tracey & Sedlacek, 1984); however, limited research has been conducted on the predictive validity for secondary school academic performance.

### **Standardized Testing Predictive Validity for Secondary School Academic Performance**

Secondary schools that rely on a selective admission process have adopted the SSAT as a method to predict high school performance (SSATB, 2014) in the same way that colleges utilize SAT scores to determine admission qualifications, student access to merit-based financial aid and overall access to higher education (NACAC, 2015). However, the research on the SSAT as a predictor is comparatively much smaller. The SSAT has been found to be effective identifying students with talent in mathematics in intermediate grades (Lupkowski-Shoplik & Assouline, 1993) and as an acceptable instrument to identify talented elementary school students when compared to results of the Johns Hopkins Talent Search Identification Model (Mills & Barnett,

1992). Specific research studies published on the SSAT predicting academic success in secondary schools are limited, although some results have shown strong support for the use of the SSAT to predict achievement (Kiley & Gable, 2013). The most well-known study exploring the association between the SSAT and GPA in independent secondary schools (Grigorenko et al., 2009) examined the correlation between academic achievement and self-regulated learning characteristics. Using an internally defined extension of the Wisdom, Intelligence and Creativity, Synthesized (WICS) theory of successful intelligence (Sternberg, 2003), the research concluded that non-cognitive measures such as self-efficacy, academic motivation and academic locus of control added additional predictive ability. The study cited the paucity of similar research in the area as a constraint and suggests more research be conducted both in the area of predictors of academic achievement in secondary schools as well as on non-cognitive predictors and in their relationship to traditional standardized testing.

### **Problem Statement**

Independent secondary schools have held consistent selection methods for incoming students to their institutions for over fifty years. More recently, the SSATB registered over 65,000 individual administrations for the SSAT in 2010, with over 50,000 students tested in the same year (SSATB, 2011). Substantial research on the role of standardized testing and its predictive ability for academic performance has taken place on post-secondary populations (Baron & Norman, 1992; Burton & Ramist, 2001; Camara & Echternacht, 2000; Mattern et al., 2008), while little research has taken place on independent school selection procedures (Grigorenko et al., 2009). Secondary schools, however, face similar issues to colleges regarding equity and access as they admit their incoming class of secondary school students (NAIS, 2012).

Just as public universities have a primary responsibility to educate the college-bound



students who reside in their state, the student body of a public secondary school most often consists of students exclusively from the school district it serves; thus, the ethnic and socio-economic demography of the district determines the demographic makeup of the secondary school. Similarly, private colleges seek to matriculate an incoming class with a wide student demographic as part of their educational mission, while independent secondary schools often draw from a larger demographic area than their locality, including regional, national, and, in the case of a boarding institution, international students. The institution under study defined the goal of its admission policy as one that “actively seeks a student body that is racially, geographically and socioeconomically diverse and welcomes applicants from all backgrounds. Differences in educational opportunities and individual circumstances are valued and taken into consideration in the decision process” (Institution under Investigation, 2012, para. 2). Both the institution under study and the governing body of independent schools, the NAIS, have closely aligned missions to provide equity and access to education across racial, ethnic and socio-economic groups (NAIS, 2012), suggesting that admission and selection procedures produce this desired end result.

Educational institutions have the instruction of their population as the foundation of their institutional missions. Appropriately selecting incoming students and equitably providing financial assistance to build the schools’ population is a similarly important responsibility. As admission decisions can be complex, institutions often ask for a wide array of information, including measurements designed to reduce the complexity and provide a predictive model for determining the students who are more likely to succeed academically. If the measurements are incorrect or inconsistent, the selection procedures are similarly problematic and interfere with an institution’s ability to fulfill its primary educational mission. The purpose of this study,

therefore, is to examine measurements used for the selection of potential secondary institution attendees and the ability of these measurements to predict secondary academic success. The research will examine the role of non-cognitive measures to predict student academic achievement, specifically the HEXACO: PI-R (Lee & Ashton, 2004) and its relationship, if any, to high school grade point average. Further, this study will seek to determine any predictive relationship between the pre-eminent national standardized test for secondary school admission, the SSAT, and high school GPA.

Research on higher education selection procedures has called into question the reliance on standardized testing as a dominant factor in admission, as it has shown to disproportionately under-predict the performance of certain populations for decades (Baron & Norman, 1992; Bok & Bowen, 1998; Crouse & Trusheim, 1988; Geiser & Studley, 2001; Keiser et al., 2015; Kling et al., 2012; Mattson, 2007; Shaw et al., 2012; Wynne 2006). As a result, research on the use of other selection methods in college admission procedures has expanded in order to explore the potential for a more equitable methodology for selection (Tracey & Sedlacek, 1984; Duckworth et al., 2007; Sternberg et al., 2010).

Secondary school admission procedures bear similar importance concerning access to educational opportunities and financial aid for independent secondary school education; yet, this area of research remains significantly limited. Standardized testing serves as a primary factor in independent school admission, potentially allowing for a similarly uncertain relationship predicting academic achievement. Research on alternative models of predicting academic achievement in secondary school populations, however, is even more limited.

### **Purpose Statement**

The theoretical foundation for this research study comes from the development of personality constructs known as the Big Five and is currently known as the Five-Factor Model (Buss, 1996). Initial research on personality first proposed core groupings of human personality characteristics in the 1930s (Thurstone, 1934) with the theory refined and the dominant characteristic categories reinforced over the next fifteen years (Fiske, 1949). The theoretical framework of the Five-Factor Model and corresponding research with the college population demonstrate that the core personality constructs (i.e., Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism) can be used to predict or explain a relationship between the constructs of a wide range of human behaviors. Costa and McCrae (1992) defined the Five-Factor Model of Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism as such: Openness relates to the traits by which individuals are open to fantasies, aesthetics, feelings, as well as novel actions, ideas, and values; Conscientiousness: traits of individuals who exhibit conscientiousness include self-discipline, being deliberately oriented, being motivated to achieve goals, and showing competence, while also preferring order and structure; Extraversion: traits of individuals who exhibit extraversion include excitement seeking, positivity, having an active nature, gregariousness and warmth; Agreeableness: traits of individuals who exhibit agreeableness include altruistic behavior, showing sympathy, compliance (versus defiance), cooperation, humility and modesty; Neuroticism: traits of individuals who exhibit neuroticism include depression, self-consciousness, impulsiveness, vulnerability and hostility. As a result, the theoretical backdrop of the Five-Factor Model has been used in research to investigate a wide range of behaviors such as social actions, educational outcomes and other aspects of human interaction, while serving as the foundation for a wide

range of personality inventories (Costa & McCrae, 1985; Goldberg, 1993; Guilford, Zimmerman, & Guilford, 1976; John, Angleitner, & Ostendorf, 1988).

Lee and Ashton (2004) developed the HEXACO: PI-R survey instrument in order to measure personality traits and characteristic attitudes such as Honesty, Openness to Experience, Extraversion, Agreeableness, Conscientiousness and Emotionality and incorporated the theoretical foundation of the Five-Factor Model to study a range of behaviors. Research using the HEXACO construct has been conducted on behaviors such as risk-taking (Weller & Thulin, 2012), integrity (Lee, Ashton, Morrison, Corderey, & Dunlop, 2008) forgiveness (Shepherd & Belicki, 2008) and workplace behavior (Zettler & Hilberg, 2010). Research using the HEXACO model on student achievement also suggests these variables may be useful in predicting academic performance (de Vries & de Vries, 2010; Furnham & Monsen, 2009; Nofle & Robins, 2007; Poropat, 2009), as the model may indicate how a student with these personality traits will achieve in the future. Given the influence of the personality constructs in the theory of the Five-Factor Model on other social, personal and political interactions, as well as on academic performance in post-secondary environments, the scores on the HEXACO: PI-R inventory may potentially contribute to the model explaining academic performance in high school students. The purpose of this correlational study, therefore, was to examine the relationship among the main variables of interest (GPA, the scores on the SSAT and the six HEXACO domains) and specifically examine the potential contribution the HEXACO domains make to the model predicting student academic performance as defined by cumulative GPA. Thus, in this research study, the domain scores on the HEXACO: PI-R personality assessment (Lee & Ashton, 2004) served as predictor variables.

Intelligence testing for academic ability using standardized tests often tests aptitude (College Board, 2012; SSATB, 2011), a measure indicating what a student is capable of achieving versus predicting what that student does achieve. As applied to this research study, personality traits found within the HEXACO: PI-R inventory (Lee & Ashton, 2004) may explain some of the variations in student performance beyond that is predicted by models utilizing standardized tests and GPA alone, a contribution that could potentially expand the model of predicting student academic performance. Therefore, the sub-scores on the SSAT served as a control variable. Although little research exists on the predictive validity of the SSAT (Schueger & Dizney, 1967; Grigorenko et al., 2009), independent secondary schools utilize the SSAT in a manner designed to mirror the use of the SAT in post-secondary populations and to predict student performance (SSATB, 2011). As the sub-scores on the SSAT hold a key role in the prediction model for secondary schools (SSATB, 2014) and this research attempts to investigate what role the HEXACO: PI-R traits might add to the prediction model for academic success beyond standardized tests, the research model controlled for the sub-scores of the SSAT to discover what, if any, the HEXACO: PI-R domains contribute beyond those sub-scores.

Research predicting academic success with aptitude testing as predictor variables in both secondary (Schueger & Dizney, 1967; Grigorenko et.al., 2009) and post-secondary environments (Geiser & Santilices, 2007; Geiser & Studley, 2001; Kobrin et al., 2008; Rothstein, 2004) have also examined the predictive validity across demographic categories such as race (Leonard & Jiang, 1999; Ramist et al., 1994; Wainer & Steinberg, 1992) and gender (Geiser & Santilices, 2007; Geiser & Studley, 2001; Kobrin, et al., 2008; Rothstein, 2004). In these studies, the demographics have been examined as predictor variables and have been shown to have predictive validity as part of the model for academic success. Therefore, as race and gender have

been shown to be relevant to predicting student performance outcomes they will serve as control variables rather than mediating or moderating variables in this study to isolate the potential predictive power of the of HEXACO domains. The remaining variable of interest will be the criterion variable of student academic achievement as measured by cumulative high school GPA on a 0.0-4.3 scale.

### **Significance of the Study**

This research study is significant for its overall contribution to the discipline of education, specifically of the role of academic prediction in selective admission practices, the contribution the study may make to the theories of personality constructs and non-cognitive indicators of intelligence or ability, and the contribution to further refining the potential role that academic institutions play in providing equity and access for the full range of students and student achievement. This research study specifically examined the prediction of academic success in secondary school populations.

Research studies have suggested inconsistent or inaccurate predictive power in the use of standardized testing measurements that assess potential academic performance (Burton & Ramist, 2001; Camara & Echternacht, 2000; Geiser & Santelices, 2007; Kobrin, et al., 2008) with those inconsistencies or potential questions increased when issues such as race, gender, socio-economic status or family educational attendance patterns are evaluated (Crouse & Trusheim, 1988; Leonard & Jiang, 1999; McGraw et al., 2006; Ramist et al., 1994; Ting, 1998; Wainer & Steinberg, 1992). As colleges and universities utilize these instruments as determinants of admission opportunities and financial aid (NACAC, 2015), the importance of effective, accurate and non-discriminatory selection practices increases concurrently for the

consistently growing college-bound demographic of those populations (Bailey & Dynarski, 2011; Kinzie et al., 2004; NACAC, 2015; NCES, 2015).

Non-cognitive predictors of academic achievement have been seen as potential contributors to the overall model of predicting academic achievement and potentially mitigate some of the limitations on sub-populations that standardized testing may present (Duckworth et al., 2007; Nofle & Robins, 2007; Sternberg et al., 2010; Tracey & Sedlacek, 1984), suggesting that more research on non-cognitive predictors take place to improve the selection model. The HEXACO: PI-R has been used in a limited fashion as a predictor of academic success (de Vries & de Vries, 2010; Furnham & Monsen, 2009; Nofle & Robins, 2007; Poropat, 2009), so this research study adds to the body of knowledge on the use of these type of inventories, may similarly add to the potential accuracy of academic prediction models, and in turn it may potentially contribute to the efficacy and equity of admission and selection practices.

As secondary school selective admission practices mirror the post-secondary models closely (SSATB, 2012), a similar need for accurate and equitable selection and prediction models exists. However, research evaluating the use of standardized testing as a screening mechanism and academic predictor at the secondary school level is substantially smaller (Grigorenko et al., 2009), even with the stated institutional missions for providing access for diverse populations in a manner similar to post-secondary institutions (NAIS, 2012).

Overall, this study sought to address a gap in the research literature regarding independent secondary school admission policies and procedures for predicting academic success, contribute to the growing research body on non-cognitive predictors of academic performance, as well as contribute to the greater understanding of how admission and selection

models may be refined or improved to reflect the changing demographic trends in educational attainment in the United States.

### **Research Question**

**RQ1:** Will the HEXACO: PI-R personality domains significantly predict high school students' GPA when controlling for the demographic variables of gender and race and the academic variable of the SSAT sub-scores?

### **Null Hypotheses**

**H<sub>01</sub>:** The HEXACO: PI-R personality domains will not significantly predict high school students' GPA when controlling for the demographic variables of gender and race and the academic variable of the SSAT sub-scores.

**H<sub>02</sub>:** The demographic variables of race and gender and the academic variable of the sub-scores on the SSAT will not significantly contribute to the model for predicting high school students' GPA.

**H<sub>03</sub>:** The high school students' scores on the HEXACO: PI-R domains will not significantly contribute to the model for predicting high school students' GPA.

### **Identification of Variables**

This study contained the criterion variable of high school students' GPA, the academic control variables of the sub-scores of the SSAT, the demographic control variables of race and gender, and the predictor variables of the six HEXACO domains. The institution studied assigned a cumulative GPA to each student based on the total points earned in each course in each term on a 0.0- 4.3/F–A+ unweighted scale, and the GPA served as the criterion variable in the research study. The demographic variables of race and gender were two control variables in the study. The third control variable was the individual student sub-scores on the SSAT. The



SSAT is a nationally normed, standardized psychometric examination that uses a 1500–2400 score range based on three sections: Verbal, Quantitative, and Reading (SSATB, 2010). The predictor variables used were the six individual domain scores on the HEXACO: PI-R (Lee & Ashton, 2004). The results of the survey questions create a numerical average based on the respondent's self-rating of applicability on each characteristic. Honesty-Humility is the domain covering the following: rules, social status, and patterns of manipulating others. Emotionality is the domain considering fear(s), the need for emotional support and attachment, as well as stress and worry. Extraversion is the domain concerning social situations, social activities, and positive/negative self-concept. Agreeableness (versus Anger) is the domain which includes issues of anger, judgment of others, and compromise and cooperation. Conscientiousness is the domain that covers personal discipline, organization, and impulse control. Openness to Experience is the domain that considers appreciation of art and beauty, intellectual curiosity, and intellectual exploration (Ashton & Lee, 2004).

### **Definitions**

1. *Academic Achievement* - Assigned grades and grade point average (GPA) are the most commonly used measurement of academic success (York, Gibson, & Rankin, 2015).
2. *Five-Factor Model* - The Five-Factor Model consists of core personality constructs (Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism) that can be used to predict or explain a relationship between the constructs of a wide range of human behaviors (Costa & McCrae, 1992).
3. *Fixed Mindset* - Individuals who self-determine early in his or her life that the academic success obtained is based predominantly on innate ability are said to have a

fixed mindset, as their self-perception is that their intelligence is a stationary measurement and unable to expand or grow (Dweck, 2006, p. 6).

4. *Gender* - Gender is a demographic categorization that separates individuals in members of two distinct groups: male and female. Gender is both a biologically and socially constructed method of defining an individual's identification within those two groups, and research suggests that gender has been conflated with or used synonymously with sex (Glaser & Smith, 2008).
5. *Growth Mindset* - Individuals who perceive that their innate intelligence is subject to expansion in the future or their intellectual abilities have a basis for improvement built by additional stimuli, directed work and/or further education are said to have a growth mindset (Dweck, 2006, p. 7).
6. *HEXACO: PI-R* - HEXACO Personality Inventory-Revised is an instrument that assesses six major dimensions of personality: Honesty-Humility, Emotionality, Extraversion, Agreeableness (versus Anger), Conscientiousness, and Openness to Experience (Ashton & Lee, 2009).
7. *HEXACO: PI-R - Agreeableness (versus Anger)* - Persons with very high scores on the Agreeableness scale forgive the wrongs that they suffered, are lenient in judging others, are willing to compromise and cooperate with others, and can easily control their temper. Conversely, persons with very low scores on this scale hold grudges against those who have harmed them, are rather critical of others' shortcomings, are stubborn in defending their point of view, and feel anger readily in response to mistreatment. (Ashton & Lee, 2009).

8. *HEXACO: PI-R – Conscientiousness* - Persons with very high scores on the Conscientiousness scale organize their time and their physical surroundings, work in a disciplined way toward their goals, strive for accuracy and perfection in their tasks, and deliberate carefully when making decisions. Conversely, persons with very low scores on this scale tend to be unconcerned with orderly surroundings or schedules, avoid difficult tasks or challenging goals, are satisfied with work that contains some errors, and make decisions on impulse or with little reflection (Ashton & Lee, 2009).
9. *HEXACO: PI-R – Emotionality* - Persons with very high scores on the Emotionality scale experience fear of physical dangers, experience anxiety in response to life's stresses, feel a need for emotional support from others, and feel empathy and sentimental attachments with others. Conversely, persons with very low scores on this scale are not deterred by the prospect of physical harm, feel little worry even in stressful situations, have little need to share their concerns with others, and feel emotionally detached from others (Ashton & Lee, 2009).
10. *HEXACO: PI-R – Extraversion* - Persons with very high scores on the Extraversion scale feel positively about themselves, feel confident when leading or addressing groups of people, enjoy social gatherings and interactions, and experience positive feelings of enthusiasm and energy. Conversely, persons with very low scores on this scale consider themselves unpopular, feel awkward when they are the center of social attention, are indifferent to social activities, and feel less lively and optimistic than others do (Ashton & Lee, 2009).
11. *HEXACO: PI-R - Honesty-Humility* - Persons with very high scores on the Honesty-Humility scale avoid manipulating others for personal gain, feel little temptation to

break rules, are uninterested in lavish wealth and luxuries, and feel no special entitlement to elevated social status. Conversely, persons with very low scores on this scale will flatter others to get what they want, are inclined to break rules for personal profit, are motivated by material gain, and feel a strong sense of self-importance (Ashton & Lee, 2009).

12. *HEXACO: PI-R - Openness to Experience* - Persons with very high scores on the Openness to Experience scale become absorbed in the beauty of art and nature, investigate various domains of knowledge, use their imagination freely in everyday life, and take an interest in unusual ideas or people. Conversely, persons with very low scores on this scale are rather unimpressed by most works of art, feel little intellectual curiosity, avoid creative pursuits, and feel little attraction toward ideas that may seem radical or unconventional (Ashton & Lee, 2009).

13. *Non-cognitive variables* - Non-cognitive variables are those psychosocial factors relating to adjustment, motivation, and student perceptions. These factors are different from the traditional verbal and quantitative (often called cognitive) areas affecting performance that are typically measured by standardized tests (Sedlacek, 2005).

14. *Race* - Race is a demographic variable that categorizes individuals as members of five distinct groups: White, Black, Asian-American, Native American and Hispanic/Latino/a. Race is both a biologically and socially constructed method of defining an individual's identification within those five groups and their variants (McCarthy & Crichlow, 1993).

15. *SAT* - The SAT, formerly known as the Scholastic Aptitude Test but now called only by the letters SAT, is a multiple-choice test consisting of three sections: Critical Reading, Mathematics, and Writing. The SAT is an entry exam designed for students seeking entrance to post-secondary institutions both public and private (College Board, 2013).
16. *Secondary School Admissions Test (SSAT)* - The SSAT is a multiple-choice test that consists of verbal, quantitative (math), and reading comprehension sections, plus an unscored writing sample. The SSAT is an entry exam designed for students seeking entrance to independent, secondary schools (SSATB, 2015).
17. *Self-discipline* - Self-discipline is the ability to contain certain responses in the expectation or aspiration of a higher goal by virtue of a conscious effort. Aspects of self-discipline include paying attention rather than daydreaming, maintaining one's anger or frustration, persisting on a long-term assignments, and reading the directions before beginning a test rather than starting impulsively (Duckworth & Seligman, 2006a).
18. *Standardized testing* - Standardized testing used in admission and selection procedures refers to norm-referenced examinations where the procedure, materials and scoring have been fixed and an individual's performance is interpreted in relative terms to the average performance of a referenced group (Kellaghan, Madaus, & Airasian, 1982).
19. *Triarchic theory of intelligence: Analytical* - The triarchic theory of intelligence separates intelligence into three different realms: analytical, creative, and practical. Analytical intelligence addresses characteristics of problem solving, knowledge

acquisition, componential intelligence, evaluation of situations and logical reasoning (Sternberg, 1985, 1997a).

20. *Triarchic theory of intelligence: Creative* - The triarchic theory of intelligence separates intelligence into three different realms: analytical, creative, and practical. Creative intelligence includes the ability to see nuances, operate intuitively and/or find novel or inventive approaches to problems or situations (Sternberg, 1985, 1997a).
21. *Triarchic theory of intelligence: Practical* - The triarchic theory of intelligence separates intelligence into three different realms: analytical, creative, and practical. Practical or contextual intelligence concerns an individual's ability to work within systems to have needs met or accomplish tasks. It includes the ability to adapt to conditions in order to achieve goals or needs, changing the conditions of the environment to meet goals or needs, or finding alternative environments where goals or needs can be met (Sternberg, 1985, 1997a).

### **Summary**

Selective educational institutions use both quantitative and qualitative factors to assess potential candidates as part of an admission selection process. National standardized examinations such as the SAT currently dominate post-secondary admission (NACAC, 2015) while the SSAT is a dominant factor in secondary school admission practice (SSATB, 2015). Overall, admission offices and enrollment administrators seek to weigh standardized testing with other subjective factors as they select their incoming cohorts of potential students. Additionally, admission professionals seek methods of selection that will incorporate any potential factors affecting academic achievement in a changing educational demographic, as the percentage of

women and ethnic minorities has increased in the last few decades (NCES, 2010; WICHE, 2012; NAIS, 2015) and non-cognitive predictors of academic achievement may contribute to the predictive model (Duckworth & Steinberg, 2015; Duckworth et al., 2007; Nofle & Robins, 2007; Sternberg et al., 2010; Tracey & Sedlacek, 1984). This research study sought to add to the body of knowledge concerning selective admission practices by examining if the non-cognitive personality factors found in the HEXACO: PI-R instrument adds to a predictive model for academic success as measured by GPA. The study examined the predictive relationship between the academic variables of the SSAT, the demographic variables of race and gender and the HEXACO: PI-R and asked the following main research question: Will the HEXACO: PI-R personality domains significantly predict high school students' GPA when controlling for the demographic variables of gender and race and the academic variable of the SSAT sub-scores?

## **CHAPTER TWO: LITERATURE REVIEW**

### **Introduction**

Many factors affect academic performance in college. These influences may comprise of intellectual, social or cultural contributions to a student's academic skills, including such factors as previous educational attainment, variations in socio-economic status, personal motivation, institutional or family support structure, individual self-concept, parental involvement, peer group affiliation, innate intellectual ability, as well as other potential contributory influences both internal and external to an individual student. As a wide range of influences have been shown to determine variations in student academic performance during post-secondary education, the process of successfully predicting student academic performance certainly challenges the processes of college admission professionals to select their incoming cohort with precision. Well-known and widely used standardized tests such as the SAT, formerly known as the Scholastic Aptitude Test (College Board, 2008), as well as the ACT, formerly known as the American College Testing college readiness assessment (ACT, 2008), have been used across post-secondary admission and higher education for almost one-hundred years (Lawrence, Rigol, Van Essen, & Jackson, 2002), and these tests have been repeatedly examined to assess their predictive value given their widespread use in admission practice (Burton & Ramist, 2001; Camara & Echternacht, 2000; Kobrin et al., 2008).

Recent research on standardized testing and predicting college success has looked at sub-populations and strata within the larger cohort of the college-bound population, including research specifically examining honors students (Roszkowski & Nigol, 2015), socio-economic bands within an incoming undergraduate class (Sackett et al., 2012), differing college majors (Shaw et al., 2012) as well as differences potentially found in the prediction of female students'



achievement in college (Fischer, Schult, & Hell, 2013). As secondary school assessments in curricular implementation have moved toward evaluating the Common Core standards (Common Core Standards Initiative, 2016) in the early 21st century (Weiner, 2013), research has begun to evaluate the SAT and its relationship to the college readiness skills embedded in both assessments (Kyllonen, 2012; Wiley, Shavelson, & Kurpui, 2014).

Research on the predictive ability of non-cognitive variables in post-secondary education, either in isolation or in combination with psychometric tests, has been less well-established over the last 25 years. Research suggests that non-cognitive variables may help resolve or explain a portion of the unexplained variation of student performance, particularly when evaluated in comparison to both the SAT and GPA (Cooper, 2014; Duckworth et al., 2007; McAbee & Oswald, 2013; Sternberg et al., 2010; Tracey & Sedlacek, 1984).

Selective independent secondary schools in the United States have historically followed a similar model for selecting their own incoming cohort of students, although the standardized testing process at the secondary school level appeared much later in the history of secondary school education than the original formation of the SAT did in the history of post-secondary education. In order to create a more precise predictive admission methodology for independent secondary schools, a small group of high school admission professionals and educators from a select group of institutions created the SSAT in 1957. The goal of the SSAT was for it to serve as a predictive tool for the selection and admission for the incoming secondary school students, with the structure of the SSAT test actively mirroring the structure of the SAT (SSATB, 2010). While research studies evaluating the potential influence of non-cognitive variables in post-secondary admission practices have been substantially fewer than those studies that center on standardized test assessments (Duckworth et al., 2007; Sternberg et al., 2010; Tracey &

Sedlacek, 1984), related research using non-cognitive predictors for admission on a secondary school population is in turn even less well-established (Grigorenko et al., 2009; Schueger & Dizney, 1967). The most comprehensive research study available on the use of the SSAT as a predictive tool for high school students comes from the SSATB analysis of student achievement in 1977-78 that examined academic achievement by students in 21 different independent schools in comparison with the scores on the Reading and Mathematics sections of the exam (SSAT Interpretive Guide, 1985).

Although standardized testing assessments mirroring psychometric tests such as the SAT or ACT have been the prevailing model for selective independent high schools for decades, the SSATB began to develop a version of the secondary school entrance examination in 2013 in conjunction with the Educational Testing Service (ETS), with this version adding non-cognitive factors as part of the assessment rubric. This new assessment tool had yet to be employed or evaluated for its predictive ability as of 2015; however, the intended evolution of the SSAT was to employ the new model so that independent school admission practice employs the most current selection models. If admission modeling takes both cognitive and non-cognitive measurements of potential students into account, it may enhance the ability of admission professionals to make more nuanced and refined decisions about candidates (SSATB, 2014). Further definition of the changes to the SSAT indicate that upcoming versions of the standardized test will incorporate non-cognitive variables into the assessment, specifically those deriving from the Five-Factor Model (SSATB, 2015).

The purpose of this study, therefore, was to investigate the potential relationship between the non-cognitive HEXACO personality inventory domains and the academic achievement of a secondary school population as measured by cumulative GPA. This chapter explores the origins

and evolution of standardized testing, discusses the potential limitations present in the current use of standardized testing as predictors of student performance overall and describes the most recent research using non-cognitive instruments to predict student academic success.

### **Origins of Aptitude Testing**

Modern testing by using a standardized examination in the United States began at the turn of the 20th century with the continuation of the work of French researcher, Alfred Binet (Binet, 1903). Binet's research on students with cognitive deficiencies led to the development of the Binet-Simon Intelligence Test, an assessment designed to measure abilities such as verbal acuity, memory and attention span (Binet & Simon, 1916). Binet's research included the investigation of concepts such as the correlation of measured ability and academic performance, test/re-test relationships, and instructional methodology and measured intelligence, among other content areas (Dubois, 1970). Stanford University researcher, Lewis Terman, built upon Binet's research to develop the Stanford Revision of the Binet-Simon Scale, known as the Stanford-Binet (Terman, 1916a). Terman developed the Stanford-Binet to measure individual intelligence, believing that innate ability was measurable and thus could predict academic achievement over time, while also proposing ability tests such as the Stanford-Binet can categorize ability levels across a broad continuum (Terman, 1916b). This perspective on intelligence stood in contrast to Binet's original view of intelligence, as he initially proposed intelligence could be affected by environment and was potentially malleable (Siegler, 1992).

The format and design of the Stanford-Binet was a precursor to widespread standardized testing done by the United States military in World War I. Robert Yerkes, the President of the American Psychological Association at the time, developed the Army Alpha and Army Beta tests to select and designate recruits for assignment, with the Alpha test for literate recruits and the

Beta test for illiterate recruits (Sternberg, 2000). Subsequent analysis of the Army Alpha data by Carl Brigham, a researcher and an advisor to the College Board, concluded that variations in intelligence existed between immigrant populations and native-born residents, with native-born Americans possessing superior ability. Brigham further concluded that variations in intelligence existed across ethnic backgrounds, with Nordic populations possessing superior intelligence in comparison to other ethnic backgrounds (Brigham, 1923). Brigham later retracted his conclusions on the Army Alpha data analysis (Brigham, 1930), although the analysis of the questions helped form his creation of the first version of the Scholastic Aptitude Test in 1926 (Zwick, 2007).

While psychologists and educational researchers continued to develop intelligence testing in the early part of the 20th century, an overlapping testing initiative took place in colleges and universities simultaneously. At the time, individual post-secondary institutions developed and held their own admission examinations for entry, with a differing range of style and content across those entrance exams. Twelve northeastern colleges organized a common set of examinations in response to the varying standards, forming a governing body to administer and score the test: the College Entrance Examination Board. The College Entrance Examination Board, more commonly known now as the College Board, served as the first administering body for the original SAT and serves currently as a testing body for a wide range of internationally administered standardized tests (Zwick, 2007).

The SAT has undergone a series of changes in the last 90 years, including splitting the original College Board examination into two halves, the inclusion and later removal of verbal analogies, a re-centering of the 200-800 point scale, changes in the content of the mathematics portion, and the addition of an written essay (Lawrence et al., 2002). Even with changes to the

structure of the examination and the increase in test takers from 963 in 1926 to the 1.67 million test takers in 2014, the original intent of the SAT as a standardized test has remained constant; the SAT is designed to measure the reasoning skills and critical thinking abilities necessary for academic success (College Board, 2014; Ewing, Huff, Andrews, & King, 2005; Lawrence et al., 2002).

In 2014, the College Board announced a further revision to the SAT to begin in the spring of 2016, with substantive changes to the grading structure, the scoring methodology, the use of evidence in responses and other design changes put into place to better reflect current secondary school curriculum and the expectations for academic performance in college (College Board, 2014). The changes to the SAT were also designed to be more closely aligned with the emergent Common Core Standards curriculum by revising the questions and expertise expectations, thereby potentially linking the secondary school content and expected college performance more directly (Vasavada, Carman, Hart, & Luisier, 2014). Current research suggests that the most recent changes to the SAT, specifically the combination of the verbal and written portions of the test, may assess students' literacy and critical thinking skills more accurately than previous versions of the assessment (Wiley et al., 2014).

The SSAT examination for independent secondary school admission and selection mirrors the SAT closely in both form and function, as the SSAT was originally designed to measure "student ability. It is not an achievement test; therefore, it acts as a common denominator for schools seeking to measure a student's academic capabilities" (SSATB, 2014, para. 2). The original basis for the creation of the SSAT mirrored the formation of the SAT as well. Just as the SAT was deliberately designed by universities to accommodate variations in secondary school rigor and grading practices (Zwick, 2007), the SSATB was formed in 1957 by

a collection of ten independent schools seeking to accommodate the variations of school rigor and grading practices in intermediate schools (SSATB, 2015).

In the context of this research study, any standardized test assessing the skills necessary for academic achievement in future coursework such as the SAT or the SSAT suggests continual research be conducted to assess reliability and predictive ability of that assessment, especially if the standardized test is used as a selection mechanism for including and excluding potential members of the educational community. As the current widespread use of these standardized tests affects the educational access and financial aid availability in secondary and post-secondary admission practice across the United States, that impact on potential achievement and educational access amplifies the need for research on its overall effectiveness.

In the last 40-50 years, research on college admission practice has provided a great deal of information on the predictive validity of high school grades and standardized tests on potential college success. Studies have suggested that grades and SAT scores in combination are valid predictors of academic success in college (Bridgeman, McCamley-Jenkins, & Ervin, 2000; Geiser & Santilices, 2007; Mattern et al., 2008; Patterson & Mattern, 2011; Westrick, Le, Robbins, Radunzel, & Schmidt, 2015). Geiser and Santilices (2007) studied almost 80,000 students in the University of California system and found that grades in high school college-preparatory courses were the strongest predictor of student success in college for the outcomes of four-year graduation rates, first-year college GPA, and four-year college GPA across all institutional locations, cohorts and academic departments with those grades accounting for 20.4% of the variance. The SAT Subject Test for Writing showed a lesser degree of predictive ability and the SAT Subject Test in Mathematics (Level 2) lesser still, but both SAT Subject Tests were relatively strong predictors of cumulative college GPA.

Astin and Oseguera (2005) conducted a multi-campus study and found that the variance on a six-year graduation rate could be accounted for in part by scores on the SAT (0.8%) and GPA (8.3%). Recent research on the academic achievement at the post-secondary level has shown that GPA remains the best predictor of success in college for student-athletes (McArdle, Paskus, & Boker, 2013); the results coming from an examination showing that GPA alone predicts success above both standardized tests and credit units achieved. Notably, the National Collegiate Athletic Association (NCAA), as per policy, grants athletic eligibility for competition through a combined set of criteria consisting of three thresholds: GPA, standardized testing and total credits earned across a set of core academic units (NCAA, 2015), suggesting an inconsistent application of standardized testing as a screening mechanism for this cohort. Overall, GPA is identified repeatedly as the strongest predictor of academic achievement in college across a range of research conducted in the last half century, with standardized tests such as the SAT or ACT potentially adding regular predictive value.

### **General Limitation of Prediction Studies**

Research using GPA and standardized tests have shown these factors as strong predictors of academic success, yet limitations exist. Although the two factors in combination usually account for approximately 15-30% of the variance, a significant preponderance remains unexplained and suggests research take place seeking other contributing factors. The remaining variance might be accounted for within personal circumstances, including the availability of financial resources, quality of mentorship or support, institutional influences or personality characteristics, among other potential factors, but the remaining unexplained variance implies that GPA and SATs may be insufficient for predicting students' success in college. This uncertainty increases when standardized test scores are used singly to predict success, with an

increasing uncertainty as the demographic diversity broadens within the group studied (Aguinis et al., 2016; Burton & Ramist, 2001; Camara & Echternacht, 2000; Geiser & Santelices, 2007; Kobrin et al., 2008; Sawyer, 2013).

### **Limitation of Prediction Studies with Ethnic Minorities**

While high school grades have been found to be the most accurate predictor of college success and the relative strength of grades as a predictor remains strong when examined within ethnic or racially diverse populations (Geiser & Santelices, 2007), the strength of the predictive model may decline when standardized testing is included for analysis in those same populations. When racial subgroups are examined using GPA and SAT in combination, both under-performance and over-prediction have been found. Zwick and Skylar (2005) found that the use of GPA to predict Black/African-Americans' and Latino/Hispanics' college success resulted in over-prediction; thus, these groups' performance fell short of the academic success with respect to the model's expectations. The inclusion of SAT scores mitigated the over-prediction, yet the over-prediction remained (Zwick & Schlemmer, 2004; Zwick & Skylar, 2005). Ramist, Lewis, and McCamley-Jenkins (1994) found over-prediction occurred for Latino/Hispanics, Black/African-Americans, and Native American populations when examining the relationship between SAT Subject Tests and first-year college GPA. The same research found under-prediction occurred for White/Caucasian and Asian-American populations; the former results found in a meta-analysis of 11 studies where over-prediction for first-year college GPA and SAT scores occurred for both Black/African American and Latino/Hispanic sub-groups (Young, 2003). Overall, incorrect predictions of first-year college GPA were frequent within the research studies used in this meta-analysis, including one on Asian-American populations. In some



studies, over-prediction for first-year college GPA based upon GPA and the SAT occurred for Asian Americans, while other studies resulted in under-prediction.

These findings consistently suggest that traditional predictors of college success, GPA and SAT scores in combination, provide mixed results. Some research overestimates the actual college performance of Black/African-American and Latino/Hispanic populations, while other research suggests moderate reliability for Asian-Americans (Patterson & Mattern, 2011; Shaw et al., 2012). Other research indicates that the GPA and standardized testing may not be accurate in predicting college success (Aguinis et al., 2016; Keiser et al., 2015; Leonard & Jiang, 1999; Rosner, 2012; Shaw et al., 2012; Wynne, 2006; Young, 2003). Overall, the traditional predictors of GPA and standardized test scores show imprecision in their ability to predict college success for students from culturally diverse backgrounds.

Previous studies suggest some support for the use of GPA and SAT scores as key criteria for college admission policy and practice; however, the inconsistent accuracy of these two factors remains. Research has shown that GPA and SAT scores account for a relatively small amount of variance when predicting college academic success. Further, studies involving ethnic/racial sub-groups of under-represented college populations have shown that the predictive ability of GPA and SAT scores of college success using is mixed, with models resulting in both over-prediction and under-prediction. The inconsistency in the research results suggest the de-emphasis of the use of standardized tests and GPA as primary in the post-secondary admissions process and the incorporation of a more holistic approach to the admissions process at colleges and universities. Adjusting the relative weighting of admission factors away from the current dominant position of standardized tests and toward a more balanced model may increase the likelihood of successful prediction. If admission offices employ a broader range of factors that

indicate both previously demonstrated ability and the potential for academic success, these inclusions may minimize unintentional discrimination in the college admissions process.

### **Non-Cognitive Predictors of Academic Success**

If research has suggested that the two most prevalent modes of predicting student success in college—high school GPA and standardized testing—have potential drawbacks or validity issues of their predictive abilities, it further suggests that colleges and universities that employ selection procedures for their incoming classes seek alternate modes of assessing and predicting student success in the selection process. Similarly, if the traditional predictors disproportionately under-predict the performance in the majority of the college-bound population, a conclusion based on the current percentage of college students who are women and ethnic minorities (NCES, 2010), post-secondary educational institutions should consider expanding their selection criteria to include more inclusive and valid predictors, either by utilizing different standardized testing assessments or adding new predictors to their selection model. Non-cognitive characteristics that do not fall under traditional measurement categorization include personality traits and dispositions promoting success. Several non-cognitive measures and personal attributes have shown promise in predicting achievement both in secondary and post-secondary populations.

Self-concept, defined as a self-assessment of an individual based upon family environment, individual consideration of personality traits and other external influences (Myers, 2009), has shown to be a potentially effective research variable in predicting student success in college. Studies have shown that the variation within the cognitive variables of GPA and student retention can be accounted for within the realm of self-concept, with the range of student experience, positive to negative, appearing as a particular potential variable (Zheng, Saunders, Shelley, & Whalen, 2002). Similar results were found at a technical college with a large

population of low-income minority students (Gerardi, 2005) and at an institution with a large population of adult students (Gigliotti & Gigliotti, 1998). African-American students who identify as having a strong self-concept have been shown to achieve at a higher rate (Cokley, 2002), while research examining the correlation between self-concept and performance for first-generation students has found a direct relationship between the level of self-concept and the level of performance. Studies have shown that among 32 considered personality traits, self-discipline as a variable was the only measure which predicted college GPA more accurately than SATs (Wolfe & Johnson, 1995), where research results have been replicated (Mansfield, Pinto, Parente, & Wortman, 2009).

Self-discipline has been cited as a non-cognitive personality characteristic that may explain the differences between genders and the disparity between performance on standardized testing measurements and GPA for women (Duckworth & Seligman, 2006b). In two studies with large populations, students' self-discipline correlated strongly with grades (Tangney, Baumeister, & Boone, 2004). Conscientiousness, a variation of self-discipline, has been shown to correlate to college achievement at a stronger rate than both SATs and high school GPA, suggesting that predicting success within the realm of attention-to-task and responsibility has a stronger measure than an individual's innate ability alone might suggest (Mansfield et al., 2009; Tross, Harper, Osher, & Kneidinger, 2000). Student attributes that would fall under the general category of study skills may also have predictive possibility regarding student success, as the self-disciplinary focus of students' ability to engage continually in tasks ranges across academic disciplines and general ability groupings. Traits connected to academic self-discipline such as those including organization, concentration and time management all have positive correlations to student success (Larose and Roy, 1991; George, Dixon, Stansal, Gelb, & Pheri, 2008).

Research on self-discipline as a personality characteristic has been expanded in the development of the grit scale (Duckworth et al., 2007), a construct defined as “perseverance and passion for long term goals” (p. 1087). Grit is unrelated to IQ, standardized testing scores, or other quantifiable measures of intelligence, so it avoids conflict with many of the potential confounding variables such as socio-economic status or educational attainment (Duckworth et al., 2007). Research evaluating selection methods that incorporate grit as a non-cognitive factor in conjunction with traditional methods such as the SAT have found the blended combination of factors to have stronger predictive validity than the standardized testing would alone (Cooper, 2014) and the grit characteristic predicting success also has been found to apply to African-American students who study at a predominately white university (Strayhorn, 2014).

### **Theory of a Growth versus Fixed Mindset**

An individual's view of his or her own intelligence and whether that view has a static or malleable impact on performance underlies the concept of a fixed versus growth theory of intelligence. Carol Dweck (1999, 2006) proposed that individuals attain a vision of their own intellectual abilities depending on the external stimuli they may have received as their individual self-concept evolves through early maturation. Individuals who self-determine early in his or her life that the academic success obtained is based predominantly on innate ability are said to have a fixed mindset, as their self-perception is that their intelligence is a stationary measurement and unable to expand or grow (Dweck, 2006, p. 6). Individuals who perceive that their innate intelligence is subject to expansion in the future or their intellectual abilities have a basis for improvement built by additional stimuli, directed work and/or further education are said to have a growth mindset (p. 7). Those persons with a growth mindset see personal and academic performance as a result of a combination of both internal and external factors that can be affected

by or improved upon through individual actions over a period of time; thus, any failures in an individual's academic or personal experiences are not indications of a lack of ability. Instead, those failures or struggles are learning opportunities for that individual to continue accumulating skills for future successes, with the determination that those successes will become possible through deliberate action.

In Dweck's theory, self-determination of one's mindset comes from the reinforcement and feedback an individual receives from his or her surroundings, especially during childhood, although that self-determination stimulus persists well into adulthood. Children who are praised early on for their intellectual ability, for example, begin to assume their innate ability determines their success, while children who are praised for effort and perseverance begin to assume that work ethic and effort determines success. In the context of this research study, the theory of a growth versus a fixed mindset as a non-cognitive factor affecting academic success underlies the use of standardized testing measurements for predicting performance. If the resultant score on a standardized test such as the SAT or SSAT comes from an individual with a fixed mindset, it implies that the expectation of future academic performance will likely be purely quantitatively derived, likely stable and predictable, and not subject to wide change as a result of outside forces. If the resultant score on a standardized test comes from an individual with a growth mindset, the expectation of long-term academic performance may be missing critical progressive factors that could positively influence performance in the future.

Motivation, work-ethic or curiosity may impact future performance beyond the assessed ability of the individual, as might social factors such as parental support, peer-group influence or institutional support structures. In the context of this theory of intelligence, a pure statistical prediction of academic performance based on a psychometric test may not be a sufficient

measure. An individual with a growth mindset may achieve at a greater rate than an individual with a fixed mindset with an equal or lesser assessed score, as the latter individual will expect improvement or success over time and endeavor to achieve, while the former individual may see a failure or academic plateau as a representation of the static nature of their ability. Persistence, retention, intellectual maturation and other potential characteristics of successful students in both secondary and post-secondary schools thus are unaccounted for in measurements that rely solely on a fixed predictive vision. Research on the impact of a growth mindset has shown to positively influence the achievement of students engaged in music, as eventual expertise has shown to be determined more by grit, enduring commitment, and openness to deliberate practice more than initial aptitude (Scripp, Ulibarri, & Flax, 2013) and a growth mindset has been shown to positively affect foreign language acquisition for similar learning characteristics (Mercer, 2012). Mathematics education and students' self-concept of his or her mathematic ability has shown to have a positive relationship with students who employ a growth mindset (Good, Rattan, & Dweck, 2012), while in a larger pedagogical sphere, the competence and self-concept of a specific adult instructor within educational instruction overall has been shown to be positively affected by a growth mindset (Dweck, 2014).

Growth mindset tenets have been found in more discipline-specific studies, suggesting that the influence of a growth mindset may influence student achievement in both a broad and narrow sense. Research on a growth mindset and the role it plays on setbacks on students' learning of basic and advanced computer programming has shown to positively influence persistence (Scott & Ghenai, 2014). Cato (2011) found similar results in the field of physics, as students who employed a growth mindset were found to both perform at a higher rate and work harder. Attainment of mathematical principles has been shown to be supported by growth

mindset tenets embedded in the instructional methods, as students may perceive difficult questions posed by instructors in the discipline as challenges versus threats to their ability (Sullivan & Mornane, 2011).

Scott and Ghinea (2014) examined the potential correlation that growth mindset may play on achievement and multiple intelligences when examined in relation to self-concept and Big Five personality factors, with results suggesting that interpersonal, verbal and naturalistic intelligences could be altered more easily than musical or creative intelligences. Other research has suggested that a growth mindset can be influential on students' enjoyment and persistence in pursuing music, as it may mitigate a negative student self-evaluation based on an assessment concluding a lack of innate talent (Scripp et al., 2013). Similarly, research on foreign language instruction found a comparable relationship between achievement, a growth mindset and students challenging the notion of language acquisition as determined by innate talent (Mercer, 2012), a finding suggesting that students who see language ability as determined by their own growth mindset versus any predetermined intellectual ability may be more successful.

Dweck's (1999, 2006, 2012) theory of a growth mindset proposes that motivation, reaction to setbacks, self-concept or other traits incorporating specific attitudes and behaviors affect performance beyond what a standardized measurement of intelligence might predict alone, suggesting that personality traits may have predictive power beyond standard measurements of ability. As a result, those traits should be considered when creating models predicting academic achievement. Given the current assumption and heavy reliance in higher education on standardized testing as an effective and trustworthy measure of predicting academic achievement, Dweck's theory would suggest that alternate assessments that incorporate

personality traits might be useful in order to determine potential academic achievement more accurately.

As applied to this study, the HEXACO: PI-R (Lee & Ashton, 2004) includes personality traits that would contribute to the impact of a growth mindset on student achievement.

HEXACO domains such as Openness to Experience, Conscientiousness, and Honesty-Humility specifically address characteristics that may explain variations on student performance beyond what might be predicted by standardized tests alone. Selection and admission procedures that incorporate personality traits within the HEXACO inventory then may support the influence of a growth mindset and would potentially predict academic achievement more accurately. Overall, the influence of personality domains suggests that certain characteristics within the traits on a student with a growth mindset may explain some of the variation in GPA, thus potentially suggesting a more expansive theory of intelligence, and subsequently supports the theory of personality as an influence on achievement. If so, it suggests the need for admission and selection models that incorporate personality-driven effects on student achievement. HEXACO personality traits such as Openness to Experience and Conscientiousness may contribute to a growth mindset in an academic setting, as students' willingness to accept a goal orientation and incorporate inherent inquisitiveness for new domains of information into their learning strategies may see positive academic gains beyond standard prediction methods. Conversely, students who score lower on the Honesty-Humility or Agreeableness domain level may be inflexible to growth, who display feelings of superiority or who show unwillingness to interact positively with others may have the characteristics of a fixed mindset, potentially inhibiting further intellectual growth beyond standard prediction methods.



### **The Triarchic Theory of Intelligence**

The earliest psychometric testing and the subsequent standardized testing used for prediction of performance or selection of candidates often centered an individual's core intellect as defined by the *g quotient* (Spearman, 1904). Much later, theorization on the nature of intelligence posed that intelligence may be comprised of both innate and adaptable qualities. Sternberg (1985) proposed that intelligence is not merely a static measurement, but instead incorporates both the qualities of *g* and of accumulated abilities built through adaptation, experience and intellectual processing. The triarchic theory of intelligence (Sternberg, 1985, 1997a) posits that intelligence can grow and change depending on experiential learning, exposure to environmental stimuli and social or cultural contexts. As individuals process situations, interpersonal experiences or learning opportunities in their life experiences, subsequent academic, social or interpersonal skills and adaptations develop within an internal changing intelligence that can then be transferred to other experiences. The triarchic theory separates intelligence into three discrete facets: analytical, creative, and practical (Sternberg, 1985, 1997b; see Figure 1).

The analytical facet of intelligence in the triarchic theory addresses characteristics of problem solving, knowledge acquisition, componential intelligence, evaluation of situations and logical reasoning. Individuals with strong analytical intelligence are adept at puzzles, determining cause and effect, and assessing complex situations quickly and logically. Creative thinking, however, may not be a strength of individuals with strong analytical intelligence (Sternberg, 1985, 1997a). Creative thinkers have the ability to see nuances, operate intuitively and find novel or inventive approaches to problems or situations. Experiential learning is embedded in the realm of creative intelligence, as individuals with strength in this facet take the

information gained from previous intellectual activity and transfer the knowledge gained to new situations (Sternberg, 1985, 1997a). Practical or contextual intelligence concerns an individual's ability to work within systems to have needs met or accomplish tasks. Adapting to conditions in order to achieve goals or needs, changing the conditions of the environment to meet goals or needs or finding alternative environments where goals or needs can be met if the first two approaches are not successful marks individuals who have strong practical intelligence (Sternberg, 1985, 1997a). Subsequent analysis of Sternberg's model has proposed that creativity may not serve as only a discrete mode of intelligence within a larger definition of the concept, but that the triarchic facet of creativity and general intelligence are inter-relational and could show multiple modes of interrelatedness. Creativity may serve as a subset of intelligence, with the reverse potentially being true as well, or potentially creativity and intelligence are overlapping, coincident or disjointed in their relationships. (Plucker, Esping, Kaufman, & Avitia, 2015).

In the context of this research study, the triarchic theory of intelligence suggests that assessment and predictive models investigating academic achievement incorporate the possibility that an individual will grow or adapt over time. Innate ability, as defined by a static or singular definition of intelligence, would then predict a core portion of achievement, yet the interplay of aspects of a broader definition of intelligence and individual personality traits would combine to add skills and dispositions that advance achievement beyond that core prediction. Environmental adaptation, intellectual meta-skills gained through experience or improved ability to succeed in an academic environment based on practical versus purely intellectual skills become important factors in predicting achievement for individuals. Education based in a triarchic theory of intelligence, whether secondary or post-secondary, would then be a

longitudinal experience where academic skills and personal dispositions within a discipline build upon each other toward a greater understanding of that discipline range of disciplines.

Recent research examining a triarchic theory of intelligence focuses somewhat more on academic dispositions for educational skills as a whole versus examining detailed effects that triarchic indicators may have on specific disciplines. Investigation on students' perceptions on information seeking and scholarly analysis suggesting that students who exhibit a broader range of intellectual skills based on the triarchic theory were more likely to both find enjoyment in and achieve more accuracy for searching for specifically defined and relevant information (Denison & Montgomery, 2012), while examination of students' skills within broadly stated academic areas found students exhibited greater success overall and greatest within those students exhibiting creative intellectual tendencies (Ekinici, 2014).

HEXACO PI-R domain and facet level scales include traits that include creativity, confidence, task orientation, attention to detail and knowledge seeking, among others (Lee & Ashton, 2004). The triarchic theory of intelligence facets incorporate many of the same characteristics when expanding the definition of intelligence from the original g quotient (Spearman, 1904). If personality traits such as are found in the HEXACO PI-R (Lee & Ashton, 2004) affect skill acquisition when they combine with individual innate ability, then student achievement may surpass the performance suggested by standardized tests such as the SAT or SSAT alone may indicate. This potential enhanced performance suggests that assessment of academic potential or the prediction of eventual achievement as measured by GPA incorporate these traits as factors. Secondary or post-secondary selection models that incorporate these contributing factors may gain a potentially greater predictive model of student achievement as a result.

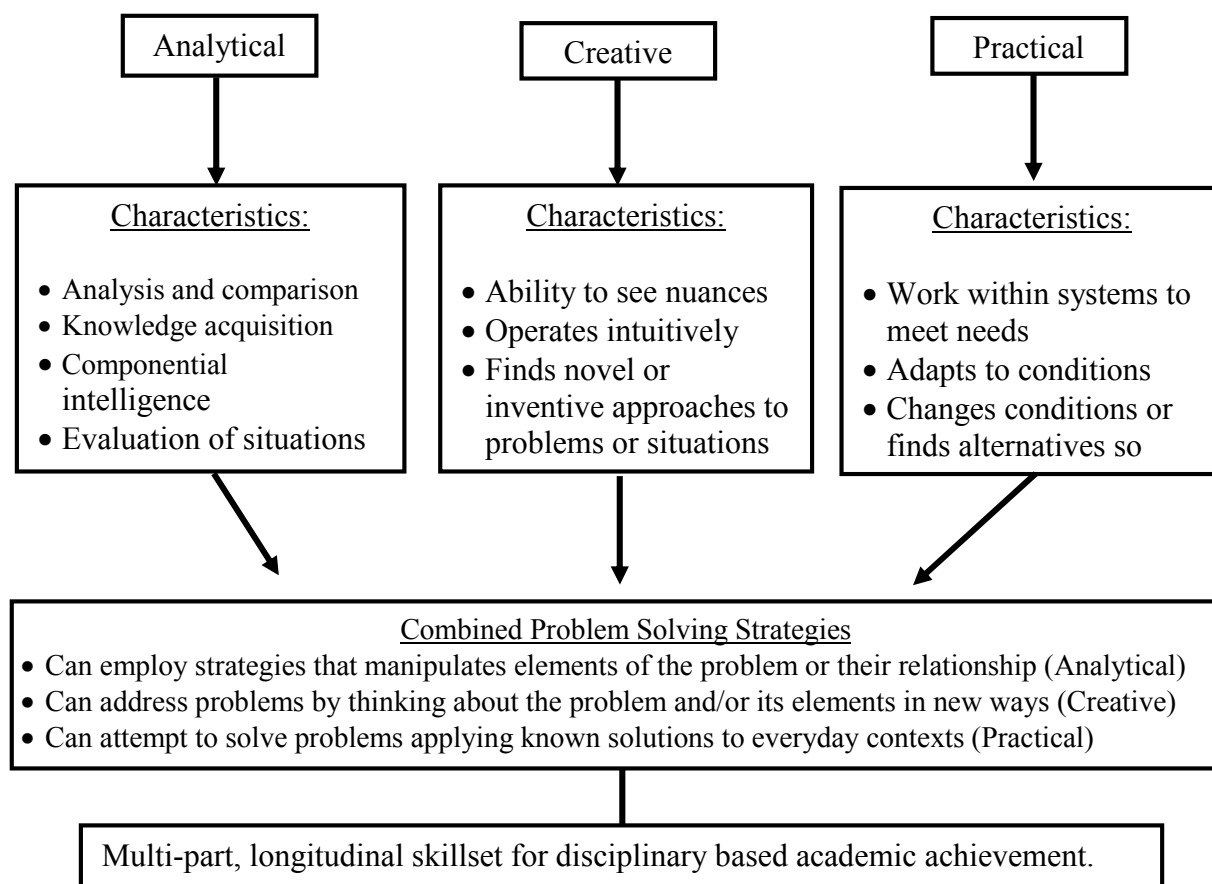


Figure 1. Disciplinary-based application of triarchic theory of intelligence.

### The Rainbow Project

One future line of research using non-cognitive factors as variables predicting student success in college may stem from Robert Sternberg's Rainbow Project, an applied use of non-cognitive variables predicting achievement in college admission at Tufts University. Sternberg (1997) argued that singularly defined representations of intelligence are misleading, they are not a culturally shared attribute, and thus the emphasis on instructional assessments that rely on memorization and surface analysis do not assess the full range of ability. After developing the Sternberg Triarchic Abilities Test (STAT) in 1993, the research used nine different analytic ability combinations to measure intelligence, eventually determining that a tripartite intelligence is a more accurate description of intellectual ability, with most learners actually having an

amalgam of analytic intelligence, creative intelligence and practical intelligence (Sternberg, 1999). When the analytical ability combinations in the STAT were examined concurrently as predictive variables with standardized analytical measures such as the SAT, the research showed predictive value of GPA increased substantially, a finding that has been replicated over time (Sternberg & the Rainbow Project Team, 2002). Later research exploring the use of non-cognitive academic indicators such as self-regulated learning attributes, academic motivation, perceived locus of control and subsets of the characteristics of the Wisdom, Intelligence, Creativity, Synthesized (WICS) in the prediction model found that these characteristics helped to predict academic success in secondary school students (Grigorenko et al., 2009). These findings led to the characteristics being embedded in the admission and selection process of a highly-selective independent secondary school, where the results suggested inclusion of these characteristics in addition to the commonly accepted use of standardized testing scores and middle school GPA to better predict success in high school (Grigorenko et al., 2009)

Further, Sternberg's research suggested that the racial and socio-economic disparity present in some of the research on academic success was substantially reduced when a triarchic approach to intelligence was incorporated. Sternberg combined Rainbow Test assessments in the application process at Tufts University by adding optional small essays and other responses with the goal of bringing student creativity to the surface. The analysis of the new admission processes suggests these approaches may be effective in creating admission and selection practices that more accurately predict academic achievement overall, increase racial/socio-economic diversity within a selected population and further predict achievement more effectively in those sub-populations (Sternberg et al., 2010). Similar results were found in research on graduate-level study, as in a related analysis of the Graduate Management Aptitude Test

(GMAT) and GPA found that variations on student performance could be partially explained by non-cognitive characteristics in a supplementary test of skills (Sternberg, & the Rainbow Project Collaborators, & University of Michigan Business School Project Collaborators, 2004) as well as having results exhibiting less disparity across gender and racial groups.

### **Big Five Traits and Personality Inventories**

The cornerstone of the research into specific domains of non-cognitive predictors and their potential effect on assessing populations begins with the exploration of the Big Five personality traits. The Big Five has evolved from numerous personality assessments and overall research, first described in the 1930s (Thurstone, 1934). Further research expanded and contracted the characteristics, with five dominant categories reinforced sixteen years later (Fiske, 1949). The individual characteristics and personality traits within the categories have been augmented, added to and removed from the overall taxonomy of personality research repeatedly as it has evolved, with the Big Five personality traits currently defined as the following: Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism. Openness included notions of intellect, but overall it refers to independence, willingness to take part in new activities, and general engagement. Conscientiousness refers to self-discipline, thoughtfulness, and ability to control personal behaviors. Extraversion considers characteristics such as excitability, sociability, talkativeness, assertiveness, and emotion. Agreeableness reflects general characteristics of empathetic behaviors such as altruism, kindness, and affection. Neuroticism considers emotional stability (or lack thereof) as the main marker for this category (Norman, 1963; Tupes & Cristal, 1961). The Big Five characteristics of personality traits have been further developed over time to expand into a theoretical construct known as the Five-Factor Model (Buss, 1996).

Currently one of the dominant measurements using non-cognitive research into student success is the Non-Cognitive Questionnaire (Sedlacek, 1989). The Non-Cognitive Questionnaire (NCQ) uses eight different facets, and components of the Big Five can be seen throughout: (a) Positive Self-Concept, whereby the student demonstrates confidence, strength of character, determination and independence; (b) Realistic self-appraisal, as within this sub-heading the student recognizes and accepts strengths or weaknesses and attempts to address any deficiencies; (c) Understanding and Dealing with Racism, where the student understands the racial mechanisms which drive or underlie whatever institutional system to which they currently connect, do/do not work to improve it, and appropriately address/do not address the difficulties; (d) Preferring Long Range Goals to Short Term Needs, otherwise considered deferred gratification; (e) Availability of Support, i.e., does the subject have a social structure which supplements his or her ability to succeed, and successful leadership experience, usually assumed to be previous leadership roles; and (f) Demonstrated community service and acquired knowledge in or about a field, where a student has/has not connected with a discipline in a meaningful way through depth and/or breadth of study. Overall, the dimensions of the NCQ described above have been found to be effective predicting academic success in college environments (Sedlacek, 1977, 1987, 1989) and research on differences across racial groups has suggested non-cognitive variables may be particularly successful predicting achievement across ethnicities (Tracey & Sedlacek, 1984, 1985, 1987, 1989).

While the NCQ was originally designed specifically to assess non-cognitive variables for minority students (Sedlacek & Brooks, 1976), the repeated use of the NCQ in other studies has shown it effective in predicting other aspects of educational importance, such as retention rates (White & Sedlacek, 1986; Sedlacek, 1993). Research on non-traditional students using non-

cognitive variables has shown predictive ability (Westbrook & Sedlacek, 1991) as well as research in other educational environments outside of undergraduate colleges, such as medical school (Sedlacek & Prieto, 1990).

Overall, research into non-cognitive domains of student success in college is a relatively recent phenomenon in higher education assessment, although the research has taken place in a range of environments. Beyond traditional college populations, the NCQ and non-cognitive research have been shown to be an effective predictor on sub-populations such as first-generation students (Ting, 1998), ethnic minorities (Tracey & Sedlacek 1984, 1985, 1987, 1989), student athletes (Sedlacek & Adams-Gaston, 1992) and international students (Boyer & Sedlacek, 1988) suggesting the NCQ has applicability and effectiveness as a research tool across a variety of populations. Other research utilizing the NCQ has found inconsistent results when looking at the academic performance of under-represented populations. The academic performance of students attending a historically Black institution was found to be best correlated to GPA, with both the SAT/ACT and the results of the NCQ questionnaire showing uneven predictive value (Lanham, Shauer & Osho, 2011). In the context of this research study, the wide range and diversity of populations where the NCQ has been shown as a valid research tool suggests that it may be effective on a new population: high school students.

Ashton and Lee (2001) drew upon the theoretical construct of the Big Five and other interpretations of the major factors of personality such as the NCQ and the Five-Factor Model to develop the HEXACO Personality Inventory. Later revisions to the personality inventory included the additions of facet level scales (Lee & Ashton, 2004) and interstitial facet scales (Lee & Ashton, 2006). Most recently, the HEXACO Personality Inventory was revised further (the HEXACO: PI-R) to reflect a more distinct definition of the facet, with one version of the



HEXACO expanding the number of questions to 200 in order to better determine where the participants fell within the domains (Ashton & Lee, 2009).

Research using the HEXACO: PI-R is relatively recent in comparison to other non-cognitive measures, although the research has investigated a wide range of behaviors. Researchers have used the Five-Factor theory and the HEXACO: PI-R to examine such human activities ranging from sexual behavior (Bourdage, Lee, Ashton & Perry, 2007) to predicting individual integrity (Lee et al., 2008). Individual and personal characteristics of populations have been examined using the HEXACO model of personality, including the examination of the trait forgiveness (Shepherd & Belicki, 2008) and the risk-taking of self-reportedly honest individuals (Weller & Thulin, 2012).

Research using the Five-Factor Model and the HEXACO Inventory has been conducted on topics such as personal value development and belief structure, including studies looking to predict religiosity, as well as research attempting to predict social and political attitudes (Leone, Chirimbolo, Desimoni, & Chirumbolo, 2012). The flexible nature of the HEXACO Inventory extends further to include research predicting interpersonal behaviors at work (Zettler & Hilberg, 2010), as well as studies on individual generosity and personal vision of the Public Good (Perugini, Tan, & Zizzo, 2010).

While research using the HEXACO inventory has spanned a wide range of behaviors, dispositions, characteristics and conditions since its development (Lee & Ashton, 2004), research evaluating the domain characteristics in relation to academic achievement and standardized academic measurements has been relatively small (de Vries et al., 2011; Nofle & Robins, 2007). Research has been conducted on the relationship between Five-Factor Model/HEXACO constructs and the SAT (Wolfe & Johnson, 1995), with the results suggesting that Self-Control

and Conscientiousness correlate positively with scores on the test. Similar results were found in a different research study suggesting a relationship between the Big Five domain Conscientiousness and the SAT (Nofle and Robbins, 2007). Conard (2006) investigated the relationships between personality behaviors and GPA in college undergraduates over three years, determining the factor of Openness as a significant factor predicting SATs. Conscientiousness has been found to predict levels of achievement as measured by grades in both high school and college (Gough & Lanning, 1966). Agreeableness has been found to have moderate predictive ability for academic achievement (Hair & Graziano, 2003) and research has posited that Emotional Stability, an explanatory construct of Neuroticism, correlates with academic achievement (Ridgell & Lounsbury, 2004).

Recent research using more specific definitions of facet-level traits within the Five-Factor Model has shown strong validity in predicting academic success for college students. When the domain of Conscientiousness from the NEO-Personality Inventory Revised, also known as the NEO-PR-R (Ashton & Lee, 2004), was further broken down into four distinct measures in a study of almost 500 undergraduates, the sub-facets within the domain were found to show more predictive ability than the domain as a whole (Woo, Jin, & LeBreton, 2015). Sub-traits of Conscientiousness were also found to predict both graduation rate and academic achievement within a single liberal arts institution in the mid-Western United States (Clark & Schroth, 2010) while other recent research supports the use of the Conscientiousness domain for predicting academic success at both the broader domain and sub-facet level of specificity (Burks et al., 2014). Similar results were found in a replicated study of research concluding that sub-domains within the Five-Factor Model were stronger predictors than the broader classification (Paunonen & Ashton, 2001), confirming the earlier results of the study and suggesting that the more

narrowly defined aspects of domains such as Conscientiousness would be stronger predictors than the domain as a whole (Paunonen & Ashton, 2013). In addition to Conscientiousness, the domains of Openness and Agreeability have been found to predict success in college in a meta-analysis of over 20 studies incorporating different iterations of the Five-Factor Model (Vedel, 2014). The results of this study showed that Conscientiousness remained the strongest predictor, while other research substantially mirrored the findings in a similar meta-analysis of 51 studies from 2009-2012 (McAbee & Oswald, 2014).

### **Summary**

Modes of predicting student academic performance and assessing intellectual ability have been evolving in the United States for over 100 years. Early strategies for prediction often centered on creating reliable testing methods for a fundamental definition of intelligence (Spearman, 1904), as well as age-cohort specific definitions of intelligence (Binet, 1903). Worldwide conflict in the early part of the 20th century created the need for screening mechanisms for military recruits, beginning the codification of large-scale standardized tests (Sternberg, 2000). These events eventually led to the formation of the first SAT, although used on a small scale and for a very narrow population at first (Zwick, 2007). In the decades following World War II, the college-bound cohort expanded dramatically as a result of the GI Bill (Zwick, 2007); thus, the needs of standardized testing changed as well to accommodate a much larger and more varied number of applicants (NCES, 2010).

As colleges and universities expanded the demographic population of their institutions, the SAT became a screening mechanism for admission practices across the country (Zwick, 2007). In this evolution, standardized tests no longer tested ability at a point in time, as early intelligence tests were designed to do, but instead they needed to predict how potential students

would later perform in the classroom at selective institutions. A second evolution of standardized testing took place when colleges and universities later expanded and diversified their populations even further in later years (NACAC, 2015; NCES, 2015). Women, ethnic minorities and other sub-populations including a greater socio-economic range of students entered the college-bound cohort and followed the same admission policies, but questions arose regarding the predictive abilities of the SAT for these new populations. Females, racial sub-groups, non-traditional students and lower income students were found to have variations in the prediction of their performance, often under-predicting their performance and impacting their access to educational opportunities (Crouse & Trusheim, 1988; Leonard & Jiang, 1999; McGraw et al., 2006; Ramist et al., 1994; Ting, 1998; Wainer & Steinberg, 1992).

Educational researchers subsequently began borrowing concepts from psychology and personality theory to determine if alternative predictors might be found. Some potential alternative predictors included considering differing modes of intelligence (Sternberg, 1985, 1997; Dweck, 1999, 2006) and how those modes might explain the variance. Other alternative models considered personality characteristics such as creativity (Sternberg et al., 2010), self-concept (Gigliotti & Gigliotti, 1998; Mattson, 2007) or perseverance and passion, i.e., grit (Duckworth & Seligman, 2007). Expansive personality models based in the original Five-Factor Model such as the HEXACO: PI-R began being used as well in research attempting to predict academic achievement (Lee & Ashton, 2004). All these models have produced results that suggest further research take place to enrich understanding of how to predict student academic achievement more effectively.

As colleges and universities began adjusting to widespread changes in their undergraduate populations as described previously, selective independent schools were

undergoing similar changes in their own population. Historically single sex institutions became co-educational and many institutions with a narrow ethnic demographic began diversifying racially and socio-economically (Cookson & Persell, 1985; NCES, 2010). During this time, as now, selection procedures for admission to these institutions remain similar, relying on standardized testing and grade point average (NAIS, 2012).

This study, therefore, sought to contribute to the greater field of education in two ways. First, the field of non-cognitive factors predicting student academic performance is relatively young and the encouraging research results suggest more studies may expand the larger understanding of non-cognitive factors. Additionally, selective admission at the post-secondary level of education has a small body of research, while admission at the secondary school level has a smaller body still, with non-cognitive research on secondary procedures in its infancy. Overall, this study will contribute to the greater body of knowledge in these specific areas and potentially help to provide greater insight into predicting student academic success across education.

## **CHAPTER THREE: METHODOLOGY**

### **Introduction**

The purpose of the study was to examine if an association exists between the HEXACO: PI-R (Lee & Ashton, 2004) and high school cumulative GPA, while controlling for the demographic variables of race and gender and the academic variables of the sub-scores on the SSAT. This chapter first discusses the research design used in the study, restates the main research question, describes the participants used in the research, and identifies the setting in which the research took place. The chapter concludes with the definitions and descriptions of the instruments, procedures and data analysis used in the research study.

### **Research Design**

A correlational research design was chosen in this study for its applicable use in non-experimental research where the variables will not be manipulated or controlled by the researcher (Ary, Jacobs, Razavieh, & Sorenson, 2006; Cohen, 1988). Correlational design research seeks to “measure the degree or strength of the relationship among two or more variables” (Ary et al, 2008, p. 30) in the manner consistent with the intended focus of this study. Similar studies on predicting academic achievement in college students (Bridgeman et al., 2000; Mattern et al., 2008; Geiser & Santilices, 2007) have utilized a correlational research design; they have been used to determine the strength of the relationship between standardized testing and academic achievement, suggesting that this research design was appropriate for this study. The primary research question that this study aimed to examine was: Will the HEXACO: PI-R personality domains significantly predict high school students GPA when controlling for the demographic variables of gender and race and the academic variable of the SSAT sub-scores?

## **Participants**

The sample for this research study was selected on the basis of convenient access to student data and was comprised of the three consecutive graduating classes from the academic years 2008-2009 through 2010-2011 of an independent, non-sectarian secondary school. Students who entered the institution in any year after the 10th grade were excluded in order to increase the similarity of student experience in the sample, as the institution had a sub-population entering in the 11th and 12th grade, including students who are post-graduates. The combination of two disparate student experiences and transcripts from multiple schools could threaten validity. Additionally, students who did not complete the HEXACO: PI-R survey (Lee & Ashton, 2004) were excluded as were students who did not submit SSAT standardized test score as part of their admission process. The cultural/ethnic composition of the student body was 15% of under-represented minority groups (African-American/Black, Latino, Native American), 17% other minority (Asian-American and Indian-American), 18% international, with the remaining 50% of the student body being domestic White/Caucasian. The total sample size of the research was 305 students after exclusions, a size which exceeds the sample necessary for research and statistical conventions given  $N \geq 104 + m$ , with “m” representing the number of predictive variables (Green, 1991). The total data set included 168 male and 137 female survey responders, with a race breakdown of 179 White/Caucasian (58.69%), 15 Latino/Hispanic (4.92%), 40 Black/African American (13.11%), and 71 Asian/Asian American (23.28%). In the context of this research study, the 179 White/Caucasian were considered a single racial category defined as “W” (White) while the remaining 126 responders were in three groupings (Latino/Hispanic, Black/African American, and Asian/Asian American) and were considered a second, single racial category of “NW” (non-white). The demographic percentages of the research data set

substantially mirrored the overall and current demographics of the institution studied, with White/Caucasian slightly overrepresented with 58.69% of the survey responders classified as the race category “White” versus 51.82% of the student body classified as “White.”

### **Setting**

The setting was a predominantly residential secondary school and was chosen based on the availability of research data, the administration’s own interest in supporting educational research, and the specific characteristic of its admission selectivity, i.e., the school’s own selection procedures mirrored a selective collegiate model. The institution was located in a suburban setting in the mid-Atlantic area of the United States, within approximately 100 miles of several major metropolitan areas.

An independent, co-educational, non-sectarian institution, the school sends 99% of its graduates to four-year post-secondary institutions and had a retention rate of 99%. This student persistence rate supports internal validity as mortality does not threaten the sample, and the steady enrollment patterns led to the conclusion that student academic experience can be considered consistent. The school utilized a standard 0.00-4.30 unweighted grading scale, a trimester schedule, and used no non-traditional instructional methods in its curriculum. Overall the curriculum was college preparatory and included multiple upper level (although non-Advanced Placement) courses, which spanned across all five major academic disciplines, as well as Religion, Philosophy, Interdisciplinary Studies, Performing Arts, and Studio Arts. The student instructional day extended from 8:00 a.m. through 3:05 p.m. Monday, Tuesday, Thursday and Friday, with required athletics or approved athletic alternatives beginning at 3:45 in the afternoon. Wednesday and Saturday were half-instructional days, with classes beginning at 8:00 a.m. and ending at 12:30 p.m. The institution expected students to adhere to study hall



restrictions for noise level and privacy. The residential life structure housed the 9th grade students together in two different dormitories, the 10th and 11th grades together into 11 different dormitories, and the 12th grade and post-graduates into four different dormitories, all separated by gender and supervised by live-in adults.

Admission to the institution was determined upon application in a similar manner to many colleges and universities. Prospective students submit transcripts, graded writing samples, answer directed writing prompts, indicate any special talents or abilities in the application, discuss future potential contributions to the academic, athletic or extra-curricular life of the school, interview with admission personnel, and submit standardized testing scores.

Applications are evaluated by an admission committee of eight admissions officers who determine the level of previous achievement and potential for future achievement. The admission timeline substantially mirrored a post-secondary environment as well, with a January 15 application deadline and candidate notification on or about March 10. The selection process admitted students into grades 9-12, including post-graduates, creating class sizes that increase from year to year: 9th grade (160 total), 10th grade (200 total), 11th grade (205 total) and 12th grade/post-graduate (230 total).

While in attendance, students are evaluated and tracked on an on-going basis by advisors, faculty, and a main administrator. Students received both written reports and assigned grades three times a year. All graded and qualitative evaluations are stored in a campus wide information management system maintained by an Office of the Registrar. Admission data remains stored and accessible only by admission personnel. The Dean of Faculty at the institution regularly conducted survey-based research on the student body to assess institutional health, including topics such as academic preparedness, measured by the Collegiate Learning

Assessment (CLA) or on general health and wellness through a self-designed survey instrument. Students completed the surveys in a study hall format, with noise and distractions prohibited during the duration of the study period, in a standard time frame that extended from 8:30 p.m. until 10:15 p.m. All students are instructed to complete the survey at the beginning of the study period and proctors restricted students to remain in their own rooms for the duration of the study hall.

Independent, secondary schools have a range of racial demography, institutional size, admission selectivity, international/domestic mix and relative overall academic strength of the students enrolled at each institution (NAIS, 2015). The specific mix of characteristics of the institution under investigation, while not quite unique, likely represents an atypical collection of defining attributes within secondary schools and these characteristics should be taken into consideration when examining the results of the analysis.

Students took the HEXACO Personality Inventory as first-year students as part of a Learning Personality Survey Initiative (LPSI), a comprehensive survey that seeks to gather data on student perceptions of their own learning styles, their individual characteristics in relation to their studies, and other factors contributing to student achievement. Included in the LPSI are questions relating to the HEXACO survey, the grit scale (Duckworth, 2007) and a Life Skills Survey (Educational Testing Service, 2014). Each year upon completion of the survey the data set was collected by the Educational Testing Service (ETS), sent to the Dean of Faculty, and stored as archival data as part of the institution's ongoing survey initiative.

### **Instrumentation**

The variables used in the study included the HEXACO: PI-R inventory domains, the quantitative sub-scores of the SSAT as a control variable, the criterion variable of cumulative high school GPA, and the demographic control variables of race and gender.

The HEXACO: PI-R served as a predictor variable and is a 100-question survey instrument that was first developed in 2000 (Ashton & Lee, 2001) and refined in 2004 (Lee & Ashton, 2004). The survey was used to evaluate six different personality domains: Honesty-Humility, Emotionality, Extraversion, Agreeableness, Conscientiousness, and Openness to Experience. Participants responded to declarative statements on the survey by assessing their relative agreement or disagreement with the characteristics or situations expressed in the statements. Participants responded to statements such as “I rarely hold a grudge, even against people who have badly wronged me” or “I plan ahead and organize things, to avoid scrambling at the last minute” on a 5-point Likert-type scale (5 = strongly agree, 4 = agree, 3 = neutral (neither agree nor disagree), 2 = disagree, 1 = strongly disagree).

As the scores from the questions on the Honesty-Humility scale increase from 1 to 5, persons tend to avoid manipulating others for personal gain, feel little temptation to break rules, are uninterested in lavish wealth and luxuries, and feel no special entitlement to elevated social status. Conversely, persons with very low scores on this scale will flatter others to get what they want, are inclined to break rules for personal profit, are motivated by material gain, and feel a strong sense of self-importance.

As scores from the questions on the Emotionality scale increase from 1 to 5, persons tend to experience fear of physical dangers, experience anxiety in response to life's stresses, feel a need for emotional support from others, and feel empathy and sentimental attachments with

others. Conversely, persons with very low scores on this scale are not deterred by the prospect of physical harm, feel little worry even in stressful situations, have little need to share their concerns with others, and feel emotionally detached from others.

As scores from the questions on the Extraversion scale increase from 1 to 5, persons tend to feel positively about themselves, feel confident when leading or addressing groups of people, enjoy social gatherings and interactions, and experience positive feelings of enthusiasm and energy. Conversely, persons with very low scores on this scale consider themselves unpopular, feel awkward when they are the center of social attention, are indifferent to social activities, and feel less lively and optimistic than others do.

As scores from the questions on the Agreeableness scale increase from 1 to 5, persons tend to forgive the wrongs that they suffered, are lenient in judging others, are willing to compromise and cooperate with others, and can easily control their temper. Conversely, persons with very low scores on this scale hold grudges against those who have harmed them, are rather critical of others' shortcomings, are stubborn in defending their point of view, and feel anger readily in response to mistreatment.

As scores from the questions on the Conscientiousness scale increase from 1 to 5, persons tend to organize their time and their physical surroundings, work in a disciplined way toward their goals, strive for accuracy and perfection in their tasks, and deliberate carefully when making decisions. Conversely, persons with very low scores on this scale tend to be unconcerned with orderly surroundings or schedules, avoid difficult tasks or challenging goals, are satisfied with work that contains some errors, and make decisions on impulse or with little reflection.

As scores from the questions on the Openness to Experience scale increase from 1 to 5, persons tend to become absorbed in the beauty of art and nature, are inquisitive about various domains of knowledge, use their imagination freely in everyday life, and take an interest in unusual ideas or people. Conversely, persons with very low scores on this scale are rather unimpressed by most works of art, feel little intellectual curiosity, avoid creative pursuits, and feel little attraction toward ideas that may seem radical or unconventional (Lee & Ashton, 2004).

Specific predictive validity studies on HEXACO: PI-R have supported the use of the measurement in social science research, with strong internal consistency reliability scores using Chronbach's alpha for Honesty-Humility (.92), Emotionality (.90), Extraversion (.92), Agreeableness (.89), Conscientiousness (.89), and Openness to Experience (.90) (Lee et al., 2008). The HEXACO inventory has been used to assess the relationship between personality traits across a wide range of characteristics and behaviors, including sexual activity (Bourdage et al., 2007), risk taking (Weller & Tikir, 2010), "Dark Triad" traits (de Vries & van Kampen, 2010), forgiveness (Shepherd & Belicki, 2008), workplace behavior (Zettler & Hilberg, 2010) and academic achievement (Nofle & Robins, 2007). In the context of this current study, the specific HEXACO: PI-R instrument used to measure the six personality factor domains: Honesty-Humility, Emotionality, Extraversion, Agreeableness, Conscientiousness, and Openness to Experience has shown a Cronbach's alpha for each of the six-factors ranging from .89 to .92 in reliability analysis conducted by the instrument's originators (Lee & Ashton, 2004). Analysis of subscales in the HEXACO: PI-R in this research study showed Cronbach results of .81 (Honesty-Humility), .76 (Emotionality), .83 (Extraversion), .72 (Agreeableness) .74 (Conscientiousness) and .78 (Openness to Experience) with a mean Cronbach  $\alpha$  of .77. As expectations for internal reliability of the score  $\alpha$  to be greater than or equal to .70 for a strong

inter-correlation among test items and an  $\alpha$  score to be greater than or equal to a score of .90 for an excellent inter-correlation among test items (Cronbach, 1970), the HEXACO: PI-R inventory suggests strong internal validity of the instrument.

Research on adolescents has used numerous personality inventories such as a Self Esteem Scale (Rosenberg, Schooler & Schoenbach, 1989), an Adolescent Risk Taking Scale (Gullone, Moore, Moss & Boyd, 2000) and an Ethnic Identity Measure (Phinney, 1992), although very little research has applied the HEXACO:PI-R (Lee & Ashton, 2004) on that population (Book, Volk, & Hosker, 2012). In regards to validity on adolescent populations, the inventory's author stated "the inventory should be suitable for high school samples, as long as the students don't have any major problems with reading comprehension or attention span, and as long as the administration sessions are supervised" (M. Ashton, personal communication, September, 14, 2013). The conditions cited by the author were present in the population and in the administration of the survey.

The scores on the sub-sections of the Secondary School Admissions Test (SSAT) will be a control variable in the study. The SSAT is a globally administered standardized test developed in the 1950s and designed to "provide a common measure for evaluating the abilities of students seeking admission to private schools, from whatever background or experience, and to assess the possible success of these students" (SSATB, 2010, para.1). The SSAT consists of three sections, including an essay and multiple-choice questions. The questions cover topics in mathematics, English language and usage and reading comprehension. The SSAT has two different levels of difficulty, a Lower Level designed for students in grades 5th through 7th and an Upper Level designed for students in 8th through 11th grades. Only the Upper Level examination was used in this research study. The test is designed with multiple versions of the five different sections to

maximize the chances that students retaking the examination will not see repeated sections. All tests are printed in English and are administered for the same duration. The SSAT is scored in three parts: Verbal, Quantitative, and Reading Comprehension. Each section has a score range from 500-800, with 800 the highest score possible (SSATB, 2011). Published or peer-reviewed research studies for the SSAT which assess its predictive ability for academic success in secondary school, either across large populations or within specific cohorts of students, are scarce (Schueger & Dizney, 1967; Grigorenko et al., 2009). While the lack of reliability data is a limitation in the research, confidence for generalizability within independent education stems from its near universal usage, sixty-year history, and worldwide usage as a required component of the application process. In 2011 the SSATB listed over 900 test centers, almost 600 member institutions in the United States, and had administered almost 58,000 SSAT tests (SSATB, 2011).

Each survey responder had an assigned gender (male/female) as well as a race designation (White/Non-White) as part of the survey construction and tied to the anonymous four-digit identification number; these demographic variables served as control variables. The institution assigns a race designation upon receiving the application, with the categories defined by the SSATB as African American, Latino/Hispanic, Native American, Asian American, Caucasian and Middle Eastern American (SSATB, 2013). In order to create a dummy variable in the design to represent the race/ethnicity variables, the category of Caucasian was coded “W” (White) and subsequently entered as 1 in the regression, and the remaining race categories (African American, Latino/Hispanic, Native American, Asian American, and Middle Eastern American) coded as the demographic variable of “NW” (Non-White) and entered as 0 in the regression.

Cumulative GPA for the participants was the criterion variable and measured on a 0.00-4.30 grading scale, with 4.30 representing the highest grade possible in each class. High school GPA has historically been considered a valid measure of achievement and thus used as the primary selection criterion in post-secondary admission practices (NACAC, 2011), with research confirming its predictive ability for academic success in college for first-year performance (Geiser & Studley, 2003) and four-year outcomes (Geiser & Santilices, 2007). Grades at the institution studied were assigned on an unweighted basis and cumulative GPA was determined by dividing the total grade points accumulated from each individually assigned term-end grade in each class and in each trimester by the total number of trimester classes completed. The grading scale was assigned as A through F, excluding E, with adjustments for plus and minus gradations in each grade category: any grade lower than D- constituted a failing grade of F. Points were assigned from 4.30 to 0.00, with A+ = 4.30, A = 4.00, A- = 3.70, B+ = 3.30, B = 3.00, B- = 2.70, C+ = 2.30, C = 2.00, C- = 1.70, D+ = 1.30, D = 1.00, D- = .70. Cumulative GPAs for the graduating class in the academic year 2010-2011 ranged from 4.12–2.84.

### **Procedures**

After approval was obtained from Liberty University's Institutional Review Board (IRB) and the institution to be studied, data collection occurred in three parts. The Dean of Faculty, who served as the school's IRB chairman in consultation with the Head Master, granted access to the academic and demographic student data. The cumulative GPAs were extracted from the data file and then demographic data for each student was assigned by linking student identification numbers. Each student was assigned a four-digit number upon matriculation that remained unique while the student was enrolled, and the designation ensured anonymity. This was the case



for the data used in this research. Three consecutive graduating classes were used to ensure adequate sample size.

Prospective students to the institution were required to submit SSAT scores as part of their application. This test is a parallel measurement to the SAT and was created to assess and predict student academic ability at the intermediate and secondary level, intentionally mirroring a college admission office's use of the SAT at the post-secondary level. The SSAT scores were a permanent part of the student's academic record and were acquired anonymously for this research by using the same four-digit identification code. Once acquired from the institution's Information Technology Services department (ITS), the SSAT data was linked to the other academic information in the overall data file.

Each spring the institution itself initiated an online survey for all students. Parents had the opportunity to decline their child's participation, but over 90% of students participated, thus mitigating selection bias. The Dean of Faculty described this survey to the student body as part of institutional research efforts designed to improve both the school's overall instructional program as well as to contribute to the greater body of educational research. The HEXACO: PI-R (Ashton & Lee, 2004) was included in this survey. The entire survey took less than fifty minutes to complete and was tied to a coded email sent to each student. Students were asked to complete the survey during required study hours by the attending dorm duty master, who supervised the evening dorm schedule as part of the school's residential structure. Students who did not complete the survey in the first mailing were reminded to complete it via email a second time later the same week. No incentive to complete the survey was included in the first or second prompt and the overall response rate averaged over 85%. The responses to the survey were also coded to the student four-digit identification number and no names were attached to

the collected answers. In this research study, the answers to the inventory questions were coded, scored, and linked to the data file by the same four-digit identification number to complete the data collection.

As the cumulative GPA, the SSAT scores and the scores within HEXACO: PI-R (Lee & Ashton, 2004) domains were all tied to the student's identification number; no names, social security numbers, addresses, or other identifying markers were present at any time. Accordingly, the data extraction was completed by the ITS department and by the researcher anonymously, thus rendering subsequent any statistical analysis similarly anonymous.

### **Data Analysis**

The hypotheses listed below were analyzed by using a hierarchical multiple regression.

**H<sub>01</sub>:** The HEXACO: PI-R personality domains will not significantly predict high school students' GPA when controlling for the demographic variables of gender and race and the academic variable of the SSAT sub-scores.

**H<sub>02</sub>:** The demographic variables of race and gender and the academic variable of the sub-scores on the SSAT will not significantly contribute to the model for predicting high school students' GPA.

**H<sub>03</sub>:** The high school students' scores on the HEXACO: PI-R domains will not significantly contribute to the model for predicting high school students' GPA.

A  $p < .05$  level of significance was used to test the hypotheses as this is the accepted threshold for significance in educational research (Ary et al., 2006; Cohen, 1988) and consistent with related correlational research on standardized testing and GPA (Burton & Ramist, 2001; Camara & Echternacht, 2000; Geiser & Santilices, 2007; Kobrin et al., 2008). Effect size of the

predictor variables was examined using the standardized coefficients to understand percent of variance explained by each of the predictor variables.

Assumption testing was completed on the data set to examine for normality, the presence of extreme outliers, homoscedasticity, multicollinearity, and independence of observations. Visual inspection of the probability-probability plots (P-P plots) of the data showed clustering in a linear manner along the theoretical cumulative distribution for all variables, suggesting no significant deviations from normality. Subsequent analysis of Q-Q plot confirmed the P-P plots suggestion of a normal distribution by confirming the data's relationship to an expected theoretical distribution. Analysis of Cook's distance resulted in a maximum value of .09, suggesting no interference with multivariate outliers within the data set. The maximum Mahalanobis distance of 62.57 was not exceeded (Tabachnick & Fidell, 1996), indicating further confirming no significant multivariate outliers, as seen in Table 1.

Homoscedasticity testing through a visual inspection of the residual scatterplot took place in order to assess the linear relationship between criterion and predictor both individually and jointly. When assessed, the scatterplots showed no erratic or non-constant results when examined against the predicted values, with a further examination of the partial regression plots exhibiting a flat and linear relationship. Both sets of plots confirmed the random dispersal of the residuals.

Multicollinearity analysis showed the majority of predictor variables to have bivariate correlations below .7 with the exception of the correlation of HEXACO: Emotionality and HEXACO: Honesty-Humility at .75. Variance Inflation Factors (VIF) analysis showed all results below 3, with results for all HEXACO: PI-R variables ranging between 1.27–2.72, similarly indicating no potential issues with multicollinearity of predictors.

Table 1

*Normality Descriptive Statistics of Mahalanobis and Cook's Distances*

Statistic	Minimum	Maximum	Mean	Standard Deviation
Mahalanobis Distance	2.35	62.57	10.96	5.61
Cook's Distance	.00	.09	.00	.01

Specific testing conditions for the administration of both measurements addressed the issue of independent observations. Administration of the SSAT requires rigorous testing procedures such as defining specific room conditions, mandating distance between test-takers, training test monitors, etc. and the survey administration of the HEXACO: PI-R (Lee & Ashton, 2004) was tied to individual email addresses and accessed during supervised study hall conditions where pre-arranged conditions separate from one another. Thus, it is highly unlikely scores on either instrument were influenced by outside factors.

As a hierarchical multiple regression was used to analyze the data, variables were entered into the analysis in blocks (see Figure 3.0). Further description of data source blocks and variables used are listed in Table 2, with the variables and their measurement methods detailed in Table 3. Block 1 contained the scores of the SSAT examination as well as the demographic variables of gender and race, while Block 2 contained the scores on the HEXACO: PI-R. In Block 1, gender was used as a demographic, categorical control variable in order to consider whether gender acted as a confounding variable in the relationship between the HEXACO domains and GPA (Ary et al., 2006; Cohen, 1988). For the differences in the relationship between gender, non-cognitive skills and grading practices have been identified as early as

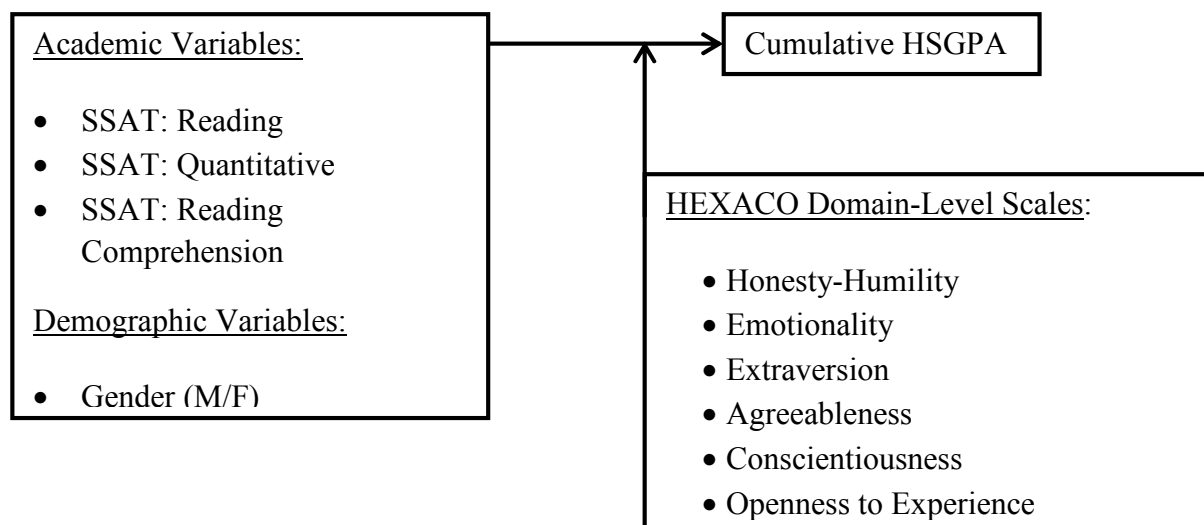
elementary school (Cornwall, Mustard, & Van Parys, 2012). Given that gender temporally precedes the performance on the survey administration of the HEXACO: PI-R, it is being considered as a potential control variable in the regression and thus entered into Block 1 of the research model. This regression model follows similar educational research that places gender as a covariate variable controlled for in the model rather than a mediating variable in prediction studies (Ancis & Sedlacek, 1995; Betts & Morell, 1999; Mattern et al., 2008).

Gender is not considered a moderator or a mediator variable in this research study as the relationship between gender and the HEXACO domains is not a specific focus of the analysis between the variables within, in contrast to research on gender and HEXACO exploring the gender difference within the domain classifications (Ashton & Lee, 2007; Costa & McCrae, 1992). Similar research exploring HEXACO and its relationship to characteristics such as risk-taking (Weller & Thulin, 2012) or honesty in the workplace (Oh, Lee, Ashton, & Reinout, 2007) ought to separate from the potential influence of gender on those outcomes. Gender has a binary designation, Male = 0 and Female = 1.

Race was included as a demographic categorical control variable using the coding White/Non-White with a binary designation, Non-White = 1 and White = 0. As race temporally precedes the performance on the survey administration of the HEXACO: PI-R survey in a manner similar to gender, it was also considered a control variable and added to the regression within Block 1. Other research on race and academic performance has explored the potential influence of race on factors predicting GPA such as discipline-based grading standards (Elliott & Strena, 1988) or choice of major (Shaw et al., 2012), showing both under-prediction or over-prediction across racial classifications. This research study sought to explore the role the HEXACO domains may have in contributing to the predictive ability of the selection methods

beyond standardized testing and potentially separate the role race may play in those contributions, such as the approach found in research models examining factors such as persistence (Duckworth, 2006a), learning strategies (Steinmayr, Bipp, & Spinath, 2011), stress (Van Heyningan, 2011) or other potential non-cognitive contributors (Conard, 2006; de Vries & de Vries, 2010). Thus, race was added as a covariate variable in this regression model.

Block 1 of the regression model also contained the academic variable of the SSAT subscores as a control variable, as standardized testing has shown predictive value in research predicting academic performance (Burton & Ramist, 2001; Camara & Echternacht, 2000; Burton & Ramist, 2001; Geiser & Santilices, 2007).



*Figure 2.* Relationship of regression variables.

Although research using the SSAT as a predictor for academic achievement in high school populations is limited (Grigorenko et al. 2009; Schueger & Dizney, 1967), research on the predictive value of SAT scores on academic performance in college is more widespread (Burton & Ramist, 2001; Camara & Echternacht, 2000; Geiser & Santilices, 2007; Kobrin et al., 2008). Following the model of previous research exploring standardized tests such as the SAT and their predictive relationship on academic achievement, this research model uses the SSAT as an academic control variable in the regression analysis to isolate the influence that the HEXACO personality domains may contribute to the prediction of academic performance. Similar research in higher education on graduate level academic achievement uses standardized tests such as the GRE (Kuncel, Hezlett, & Ones, 2001; Morrison & Morrison, 1995; Perez, 2011) or the LSAT (Thomas, 2003; Wightman, 2000) as a predictor of academic performance and mirrors the regression model uses in this research. Given similar research studies across differing levels of education that utilize standardized testing as a strong predictor of achievement, the sub-scores on the SSAT will be used as a cognitive, control variable in order to better understand the potential contribution of the HEXACO domains.

Table 2

*Data Source Blocks and Variables*

Data Source Blocks	Variables
Block 1	Academic Data SSAT: Reading SSAT: Quantitative SSAT: Reading Comprehension Demographic Data Gender (M/F) Race (W/NW)
Block 2	HEXACO: PI-R Domain Level Scales Honesty-Humility Emotionality Extraversion Agreeableness Conscientiousness Openness to Experience

In Block 2, the predictor variables of the scores on the HEXACO: PI-R (Lee & Ashton, 2004) domains were added to examine their explanatory power in the prediction model. The research study was designed in this manner to explore the potential contribution HEXACO personality characteristics may have within high school populations, an area of research with little previous study (Book et al., 2012; M. Ashton, personal communication, September 14, 2013). Nofle and Robbins (1992) investigated the role HEXACO domains played in predicting academic achievement at the college level. This model controlled for cognitive variables in order to isolate the role of the HEXACO domains on achievement, suggesting a similar model may be effective in discovering the potential contribution the domains may have on secondary school academic achievement. HEXACO domains have been utilized in similar research seeking to identify whether more narrowly defined aspects of the traits predict both incremental positive and negative effects on academic achievement beyond expected outcomes (de Vries & de Vries,



2010). Thus, this research study was designed similarly to the studies cited above to determine the potential contributions of the domains to the prediction model.

Table 3

## Variables and Measurement Methods

Theoretical Framework & Research	Variable	Data Source/Measurement	Unit of Analysis
Big Five Personality Construct/Five-Factor Model (Buss, 1996; Costa & McCrae, 1992)	HEXACO: Honesty-Humility	Self-reported survey answers to declarative statements and degree of agreement to those statements.	Likert Scale 1-5 1=Strongly Disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly Agree
Big Five Personality Construct/Five-Factor Model (Buss, 1996; Costa & McCrae, 1992)	HEXACO: Emotionality	Self-reported survey answers to declarative statements and degree of agreement to those statements.	Likert Scale 1-5 1=Strongly Disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly Agree
Big Five Personality Construct/Five-Factor Model (Buss, 1996; Costa & McCrae, 1992)	HEXACO: Extraversion	Self-reported survey answers to declarative statements and degree of agreement to those statements.	Likert Scale 1-5 1=Strongly Disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly Agree
Big Five Personality Construct/Five-Factor Model (Buss, 1996; Costa & McCrae, 1992)	HEXACO: Agreeableness	Self-reported survey answers to declarative statements and degree of agreement to those statements.	Likert Scale 1-5 1=Strongly Disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly Agree
Big Five Personality Construct/Five-Factor Model (Buss, 1996; Costa & McCrae, 1992)	HEXACO: Conscientiousness	Self-reported survey answers to declarative statements and degree of agreement to those statements.	Likert Scale 1-5 1=Strongly Disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly Agree
Big Five Personality Construct/Five-Factor Model (Buss, 1996; Costa & McCrae, 1992)	HEXACO: Openness to Experience	Self-reported survey answers to declarative statements and degree of agreement to those statements.	Likert Scale 1-5 1=Strongly Disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly Agree

Gender & Academic Modeling (Leonard & Jiang, 1999)	Gender	Institutional Archived Data	Male (coded 1) Female (coded 0)
Race & Academic Prediction Modeling (Crouse & Trusheim, 1988; Ramis, Lewis, & McCamley-Jenkins, 1994)	Race	Institutional Archived Data	Self-Identification: White (coded 1) Non-White (coded 0)
Cognitive Academic Predictor (Geiser & Santilices, 2007; Geiser & Studley, 2003)	GPA	Institutional Archived Data	Calculated/ Admission based on 4.3 scale
Institutional Admission Policy/Industry Assessment Standard (SSATB, 2014)	SSAT	Numerical Score (3 Sections)	Section Score: 500-800 Overall: 1500-2400

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## CHAPTER FOUR: FINDINGS

### Research Questions

This research study sought to examine the association between non-cognitive factors, specifically the HEXACO personality domains, on academic achievement at a selective secondary school. In post-secondary admission models, both cognitive factors (Baron & Norman, 1992; Burton & Ramist, 2011; Camara & Echternacht, 2000; Mattern et al., 2008) and non-cognitive factors (Cooper, 2014; Duckworth et al., 2007; McAbee & Oswald, 2013; Sternberg et al, 2010; Tracey and Sedlacek, 1984) have been examined as predictors of student success. However, secondary school admission models focus much more exclusively on cognitive factors such as standardized testing (College Board, 2013; SSATB, 2010, 2014). Thus, this study examined the use of non-cognitive measurements while controlling for cognitive measures and demographics to determine the potential role non-cognitive factors present as predictors of academic achievement and potential admissions criteria. This chapter discusses the results of the study. A hierarchical multiple regression analysis was used to examine the main research question: Will the HEXACO: PI-R personality domains significantly predict high school students GPA when controlling for the demographic variables of gender and race and the academic variable of the SSAT sub-scores? The regression further tested the following null hypotheses.

### Null Hypotheses

**H<sub>01</sub>:** The HEXACO: PI-R personality domains will not significantly predict high school students' GPA when controlling for the demographic variables of gender and race and the academic variable of the SSAT sub-scores.

**H<sub>0</sub>2:** The demographic variables of race and gender and the academic variable of the sub-scores on the SSAT will not significantly contribute to the model for predicting high school students' GPA.

**H<sub>0</sub>3:** The high school students' scores on the HEXACO: PI-R domains will not significantly contribute to the model for predicting high school students' GPA.

### **Data Coding**

The data set for the research study consisted of 411 responses to a HEXACO survey conducted as part of normally occurring survey procedures by the institution. During the initial survey, each respondent was given a unique four-digit identification number to ensure anonymity of responses, with the full set of answers to the HEXACO survey questions then linked to the identifying numbers. A second data set was provided by the department of the institution that consisted of student four-digit ID numbers, their SSAT scores, their cumulative GPA upon graduation, as well as race and gender demographic information. These two data sets were combined and all available data linked using a four-digit case number. Student respondents who were not four-year attendees of the institution and the 106 cases that did not have SSAT scores as part of their permanent academic record were removed. This resulted in 305 usable cases for analysis.

The average scores of the responses to the HEXACO survey were calculated individually by domain (Honesty-Humility, Emotionality, Extraversion, Agreeableness, Conscientiousness, and Openness to Experience) on a scale that ranged from 1 to 5 (1=Very Inaccurate, 2=Moderately Inaccurate, 3=Neither Accurate nor Inaccurate, 4=Moderately Accurate, and 5=Very Accurate) with the lower end of the scale indicating the least identification to the qualities associated to the domain and the highest end of the scale indicating the most identification to the

qualities associated to the domain. These scores were calculated by averaging the responses to a series of statements for each scale; each statement was derived from specific characteristics and dispositions associated to the definition of one of the six domains. For the participants in this study, the average scores for each domain in the HEXACO PI-R survey were 2.55 (Honesty-Humility), 2.58 (Emotionality), 2.65 (Extraversion), 3.07 (Agreeableness), 2.74 (Conscientiousness), and 3.44 (Openness to Experience).

The demographic variables of gender (M/F) were entered into the data set as Male = 0/Female = 1, and demographic variable of race (W/NW) entered into the data set as White = 0/Non-White = 1. The academic variable of SSAT sub-scores were determined by the testing agency (SSATB) and were calculated on a 500-800 point range. The criterion variable of cumulative GPA was calculated by the institution on a 0.00-4.30 unweighted scale representing the grade of F – A+, based on the total points earned in each course and in each term. The final, full data set of cumulative GPA upon graduation, each SSAT sub-score (Verbal, Quantitative and Reading Comprehension), the six HEXACO survey scores for each individual record and the demographic variables of gender and race were entered into SPSS.

### **Descriptive Data**

Table 4 contains descriptive information for each variable in the full data set. The mean cumulative GPA upon graduation for the population was 3.44 ( $SD = .34$ ), an average consistent with the subsequent graduating classes according to institutional data. Mean HEXACO responses ranged from a low of 2.55 (Honesty-Humility) to a high of 3.07 (Agreeableness). The total data set included 168 male (55.08%) and 137 (44.92%) female survey responders, with a race breakdown of 179 White/Caucasian (58.69 %) and 126 non-White (41.31%). The demographic of the data set mirrors the demographics of the institution studied.

Table 4

*Descriptive Statistics of Variables in the Data Set (N = 305)*

Variable Type	Variable	Mean	Std. Deviation
Criterion	12 Grade Cumulative GPA	3.44	.34
Predictor	HEXACO: Honesty-Humility	2.55	.39
	HEXACO: Emotionality	2.57	.45
	HEXACO: Extraversion	2.65	.40
	HEXACO: Agreeableness	3.07	.46
	HEXACO: Conscientiousness	3.02	.33
	HEXACO: Openness to Experience	2.73	.48
Academic Control	SSAT: Verbal	719.59	43.59
	SSAT: Quantitative	743.47	40.87
	SSAT: Reading	699.03	36.57
Demographic Control	Race: W/NW	(170) 58.69%	(126) 41.31%
	Gender: M/F	(168) 55.08%	(137) 44.82%

An examination of the bivariate correlation matrix (see Table 5) showed the Pearson correlation coefficients and their significance for each combination of variables included in the analysis, with the preliminary analysis of these associations showing a highly significant positive relationship between the SSAT and cumulative GPA. No significant pairwise associations appeared between the HEXACO variables and GPA.

Table 5

*Pearson Correlation Matrix of Variables of Interest*

	12 <sup>th</sup> Grade GPA	SSAT: V	SSAT: Q	SSAT: R	Race: W/NW	MF
12 <sup>th</sup> Grade GPA	1.00	.50**	.38**	-.07	-.01	-.01
SSAT: V	.39**	1.00	.42**	.60**	.04	-.06
SSAT: Q	.51**	.42**	1.00	.39**	-.14**	-.13*
SSAT: R	.38**	.60**	.39**	1.00	.08	-.09
Race: W/NW	-.99	.04	-.14**	.08	1.00	-.04
MF	-.01	-.06	1.00	-.09	-.04	1.00
HEXACO: Honesty- Humility	-.02	-.02	.03	.04	.07	-.13
HEXACO: Emotionality	-.03	-.02	-.05	.02	.10*	.01
HEXACO: Extraversion	-.03	-.05	-.02	.01	.06	-.13*
HEXACO: Agreeableness	-.02	.03	.02	.07	.08	-.11*
HEXACO: Conscientiousness	-.09	.03	.02	.07	.08	-.11*
HEXACO: Openness to Exp.	-.06	-.06	-.04	-.09	.01	.01

*Note.* \*  $p < .05$ , \*\*  $p < .01$

**Assumption Testing**

Assumption testing took place on the data set to inspect for normality, the occurrence of extreme outliers, homoscedasticity, multicollinearity, as well as independence of observations. Evaluation of the probability-probability plots (P-P plots) showed linear grouping along the potential and expected theoretic distribution for all variables, indicating the unlikely event of significant deviations from normality. Follow-up analysis of Q-Q plot confirmed the tenability of the assumption of normality. The analysis of Cook's distance resulted in a maximum value of



.09, indicating no interference with multivariate outliers within the data set. The maximum Mahalanobis distance of 62.57 was not exceeded (Tabachnick & Fidell, 1996), indicating further corroboration of no significant multivariate outliers, as displayed in Table 6.

Table 6

*Normality Descriptive Statistics of Mahalanobis and Cook's Distances*

Statistic	Minimum	Maximum	Mean	Standard Deviation
Mahalanobis Distance	2.35	62.57	10.96	5.61
Cook's Distance	.00	.09	.00	.01

Visual inspection of residual scatterplot to assess homoscedasticity took place in order to evaluate the linear relationship between criterion and predictor variables, both in their individual and collective relationship. The scatterplots exhibited no erratic or inconstant results when evaluated against the predicted values. Subsequent analysis of the partial regression plots displayed a linear and even relationship, as each set of plots confirmed the random dispersal of the residuals. Multicollinearity analysis indicated all predictor variables to have bivariate correlations below .75, indicating no violation of the assumption of no multicollinearity (Rubin, 2012). Additionally, VIF analysis indicated all results below 3.00, with all HEXACO: PI-R variables ranging between 1.27–2.72, similarly indicating no violation of the assumption of no multicollinearity. The testing conditions and the issue of independent observations were addressed directly by the conditions of the specific administration. The SSAT board specifically requires testing procedures that define the condition of the room where the testing takes place (including a pre-determined distance between the individual test-takers), that requires detailed training of the administrators, etc. and that, in this specific case, the administration of the HEXACO: PI-R (Lee & Ashton, 2004) testing is linked electronically to separate email addresses which could only be accessed during supervised conditions. Scores on either instrument are highly unlikely to be influenced by any outside factors during the administration.

The assumption testing as a whole, including testing for normality, the occurrence of extreme outliers, homoscedasticity, multicollinearity, and independence of observations, found no violations, thus deeming the data set appropriate for the use of a parametric analysis, including the hierarchical multiple regression analysis.

### Findings

The hierarchical multiple regression analysis was then conducted to address the main research question. Block 1, the combination of three SSAT sub-scores and the demographic variables of race and gender, was a statistically significant model for predicting cumulative high school GPA,  $F(5, 299) = 27.20$ ,  $p = .001$ . Block 1 explained approximately 31.30% of the variance of cumulative high school GPA,  $R^2 = .31$ . Thus, significant evidence existed to reject the null hypothesis H<sub>02</sub>: The demographic variables of race and gender and the academic variable of the sub-scores on the SSAT will not significantly contribute to the model for predicting high school students' GPA.

Table 7 shows the bivariate, partial, beta correlations of the predictor variables with GPA, as well as how well each control variable individually contributed to the prediction of the criterion variable. Examination of each individual relationship between the SSAT sub-score and student cumulative GPA showed that as each of the SSAT sub-scores increased, the student GPA increased as well. Individual sub-score of the SSAT: Quantitative had a positive, significant association with cumulative GPA at the  $p = .01$  level, and the individual sub-score of the SSAT: Verbal and SSAT: Reading both had a positive, significant relationship to cumulative GPA at the  $p = .05$  level. The individual variable of SSAT: Quantitative ( $\beta = .40$ ) explained 12% of the variance of the criterion, while the individual variables SSAT-Verbal ( $\beta = .14$ ) and SSAT: Reading ( $\beta = -.15$ ,  $R^2 = .01$ ) explained only 1% of the variance in the criterion. The demographic

variables of race and gender in the Block did not show any individual, significant contribution to the model.

The addition of the variables in Block 2, which included the individual mean scores on the HEXACO domains, did not contribute to the model for predicting cumulative high school GPA with  $R^2$  change = .02,  $F(6, 293) = .96, p = .450$ . As the inclusion of HEXACO domains to the overall model showed no significant predictive additive relationship to cumulative GPA, the null hypothesis  $H_03$ : The high school students' scores on the HEXACO: PI-R domains will not significantly contribute to the model for predicting high school students' GPA, is not rejected.

The findings for the entire model, which included the demographic variables of race and gender, the individual mean student scores on the HEXACO domain instrument, and the academic variable of the SSAT sub-scores, were significant  $F(11, 293) = 12.88, p = .001$ , with an effect size of  $R^2 = .33$ , indicating that 33% of the variance in GPA was explained by the total model. When examining the entire model, which explored the relationship among all variables in the research study, including the demographic and academic variables, the analysis findings led the researcher to reject  $H_01$ .

Table 7

*Coefficients and Part/Partial Correlations of All Blocked Variables on 12<sup>th</sup> Grade Cumulative GPA*

	Zero- Order	Part	Partial <i>r</i>	$\beta$	<i>SE B</i>	<i>B</i>	<i>t</i>	<i>p</i>
SSAT: Verbal	.39*	.12	.13	.14	.00	.01	-2.22	.03*
SSAT: Reading	.38**	.11	.13	.13	.03	.01	2.24	.00**
SSAT: Quantitative	.51**	.36	.39	.41	.00	.01	7.39	.00**
Race: W/NW	-.02	.03	.03	.03	.03	.02	.56	.56
Gender: M/F	-.01	.06	.08	.06	.14	.04	1.33	.18
HEXACO: Honesty-Humility	-.02	.01	.02	.02	.06	.02	.27	.78
HEXACO: Emotionality	-.03	-.01	-.01	-.00	.06	-.01	-.01	.99
HEXACO: eXtraversion	-.01	-.02	-.03	.03	.07	.03	-.41	.67
HEXACO: Agreeableness	-.01	-.02	-.03	-.03	.04	-.02	.43	.67
HEXACO: Conscientiousness	-.09*	-.10	-.12	-.12	.06	-.13	-2.10	.03*
HEXACO: Openness to Experience	-.06	-.01	-.02	-.01	.04	.01	-.04	.97

*Note.* \*  $p < .05$ , \*\*  $p < .01$

The findings for the individual contributions to the entire model (see Table 8) show that each individual sub-score of the SSAT (Quantitative,  $\beta=.408$ ,  $p=.001$ ; Verbal,  $\beta=.138$ ,  $p=.027$ ; Reading,  $\beta=.139$ ,  $p=.025$ ) exhibited a statistically significant explanatory relationship to the variable of cumulative GPA. The findings for the individual demographic variables of race and gender showed no statistically significant explanatory relationship to the variable of cumulative GPA (W/NW,  $\beta=.064$ ,  $p=.184$ ; M/F,  $\beta=.028$ ,  $p=.566$ ). The findings for the following individual variables of the HEXACO scores showed no statistically significant relationship on the variable of cumulative GPA for Honesty-Humility ( $\beta=.02$ ,  $p=.78$ );

Emotionality ( $\beta = -.00$ ,  $p = .99$ ); Extraversion ( $\beta = .03$ ,  $p = .67$ ); Agreeableness ( $\beta = -.03$ ,  $p = .67$ ); and Openness ( $\beta = -.01$ ,  $p = .97$ ). The single HEXACO variable showing a statistically significant relationship to the variable of cumulative GPA was Conscientiousness ( $\beta = -.13$ ,  $p = .03$ ).

### Summary

The data analysis examined three null hypotheses derived from the main research question, and the results are discussed here in text form and summarized in Table 9. The first hypothesis,  $H_{01}$ , stated that the HEXACO: PI-R personality domains will not significantly predict high school students' GPA when controlling for the demographic variables of gender and race and the academic variable of the SSAT sub-scores.

The analysis of the total model shows a significant overall predictive value of  $F(11, 293) = 12.88$ ,  $p = .001$ , with an effect size of  $R^2 = .33$ , and thus the full model explains 33% of the variance in GPA, a comparatively large effect within educational research and behavioral sciences (Cohen, 1988). Thus the overall model, which included the demographic variables of race and gender and the academic variable of the SSAT sub-scores, was a significant predictor of high school students' GPA and so the null  $H_{01}$  was rejected.

Table 8

*Contributions of Individual Criterion Variables*

Variable	Zero-Order	Partial <i>r</i>	$\beta$	<i>SE B</i>	<i>B</i>	<i>t</i>	<i>p</i>
SSAT: Verbal	.39*	.13	.14	.00	.00	2.23	.003*
SSAT: Reading	.38*	.14	.15	.01	.01	2.36	.002*
SSAT: Quantitative	.51**	.38	.40	.00	.01	7.07	.001**
Race: W/NW	.13	.03	.02	.01	.01	.48	.630
Gender: M/F	-.01	.07	.06	.03	.04	1.27	.200

*Note:* \* $p < .05$ , \*\* $p < .01$

The second hypothesis, H<sub>02</sub>, stated that the demographic variables of race and gender and the academic variable of the sub-scores on the SSAT will not significantly contribute to the model for predicting high school students' GPA. In examining H<sub>02</sub>, the analysis showed that the Block containing these variables was significant ( $R^2 = .31$ , adjusted  $R^2 = .30$ ,  $F(5, 299) = 27.20$ ,  $p = .001$ ), with the Block explaining 31% of the variance in GPA, a large effect within educational research and behavioral sciences (Cohen, 1988). Thus, the null H<sub>02</sub> was rejected.

The third hypothesis, H<sub>03</sub>, stated that the high school students' scores on the HEXACO: PI-R domains will not significantly contribute to the model for predicting high school students' GPA. In examining H<sub>03</sub>, the analysis showed that the HEXACO domains on their own were not significant predictors of GPA when added to the model,  $F(6, 293) = .96$ ,  $p = .450$ ,  $R^2 = .02$ , explaining only 1% of the variance, an extremely small and statistically insignificant variance in GPA within educational research and behavioral sciences (Cohen, 1988). Thus, in the case of H<sub>03</sub>, HEXACO: PI-R domains were not predictors of high school students' GPA and the null was not rejected.

Table 9

*Analysis and Conclusions of Null Hypotheses*

Hypothesis	Statistics	Decision about the Null	Conclusion
<b>H<sub>01</sub>:</b> The HEXACO: PI-R personality domains will not significantly predict high school students' GPA when controlling for the demographic variables of gender and race and the academic variable of the SSAT sub-scores.	$F(11, 293) = 12.88$ $p = .001$ $R^2 = .33$	Reject the Null H <sub>01</sub>	The HEXACO: PI-R personality domains do significantly predict high school students' GPA when controlling for the demographic variables of gender and race and the academic variable of the SSAT sub-scores.
<b>H<sub>02</sub>:</b> The demographic variables of race and gender and the academic variable of the sub-scores on the SSAT will not significantly contribute to the model for predicting high school students' GPA.	$F(5, 299) = 27.20$ $p = .001$ , $R^2 = .31$ (adjusted $R^2 = .301$ )	Reject the Null H <sub>02</sub>	The demographic variables of race and gender and the academic variable of the sub-scores on the SSAT do significantly contribute to the model for predicting high school students' GPA.
<b>H<sub>03</sub>:</b> The high school students' scores on the HEXACO: PI-R domains will not significantly contribute to the model for predicting high school students' GPA.	$F(6, 293) = .96$ $p = .450$ , $R^2$ change = .02	Fail to Reject the Null H <sub>03</sub>	The high school students' scores on the HEXACO: PI-R domains do not significantly contribute to the model for predicting high school students' GPA.



## CHAPTER FIVE: DISCUSSION

### Overview

Educational institutions that utilize selective admission procedures strive to find effective and accurate measurements to predict the future success of any potential matriculates. Standardized tests such as the SAT or ACT have been a dominant factor in these admission procedures for most of the last 100 years. More recently, educational researchers have investigated alternatives to traditional psychometric tests to accommodate expanding educational demographics, most often to account for potential inconsistencies in certain college-bound groups within the larger cohort, such as women or underrepresented minority students (Kobrin, et al, 2008; Rosner, 2012; Soares, 2011). These investigations have included expanding or refining the definition of intelligence in an attempt to discover alternative predictors (Sternberg, 1999, 2003), researching the role of creativity (Sternberg et al., 2010), and examining non-cognitive measures or personality characteristics such as grit (Duckworth, & Gross, 2014; Duckworth, Kirby, Tsukayama, Berstein, & Kelly, 2007; Duckworth et al., 2007). As research examining predictors of academic achievement has historically focused more frequently on post-secondary education, this research study investigated the use of the personality domains found in the HEXACO: PI-R (Ashton & Lee, 2004) within a secondary school environment to add both to the research literature on non-cognitive predictors and to determine if these personality domains could add to the selection procedures for predicting academic success within high school age populations.

This chapter discusses the research study by analyzing and explaining the results in the context of the study's original research hypotheses and then uses the findings within to examine the relationship this research may have to previous research and theory. Implications for future

research, including methodological implications, are also examined in order to provide recommendations for future research into the topic area and to suggest possible future research designs that may be more rigorous or more effective. Limitations of the study are also examined in this chapter, as well as a summary and conclusions of the research.

### **Discussion of Results**

The analysis of three consecutive graduating classes at a selective, independent secondary school indicated that the HEXACO personality domains were not significant predictors of cumulative GPA and that the best predictors of academic success were the sub-scores on the SSAT. In conducting a hierarchical multiple regression, the overall model, which included the three SSAT sub-scores, the demographic variables of race and gender and the HEXACO variables, made a statistically significant contribution to the model for predicting cumulative high school GPA, explaining approximately 33% of the variance of cumulative high school GPA. Block 1 on its own, which included the academic variables of the individual sub-scores of the SSAT, made a statistically significant contribution to the model, explaining 31.% of the variance. Block 2 on its own, which included only the HEXACO domains, did not additionally contribute significantly to the model for predicting cumulative GPA.

All three sections of the SSAT were significant predictors of academic success, with the SSAT-Quantitative the strongest individual predictor. Schueger and Dizney (1967) similarly found the quantitative component of the SSAT to be the strongest predictor of GPA for a similar population. With little previous research on the predictive validity of the SSAT on secondary school achievement (Grigorenko et al., 2009; Schueger & Dizney, 1967), this study adds to the evidence that the use of the SSAT is an effective method for predicting academic success in secondary school students. More specifically, the results demonstrate that the SSAT sub-scores

are a good predictor of high school academic success for selective secondary schools seeking to predict academic success as measured by GPA. The results also demonstrate that secondary schools with a diverse domestic, international and/or gender demography within the student body will find the SSAT strongly predicts student achievement as measured by cumulative GPA.

The results of this research study on a secondary school also mirror the research that showed some predictive ability of the SAT on academic performance on post-secondary sample populations (Burton & Ramist, 2001; Camara & Echternacht, 2000; Geiser & Santilices, 2007; Kobrin et al., 2008), as well as mirroring research that has predicted some of the variation in academic performance on graduate level populations taking the GRE examination (Kuncel et al., 2001; Morrison & Morrison, 1995) or the LSAT (Thomas, 2003; Wightman, 2000).

Other research examining high school and pre-college population has suggested that environmental factors or outside support structures may mitigate any impact that race or gender differences might have on predicting student academic success. Internal support systems have been found to predict success in diverse, urban environments (Walsh et al., 2014) and an individual's feelings of connection and belonging to one's high school were directly and positively correlated with academic success (Neel & Fuligni, 2013). As the institution under investigation had a comprehensive, deeply embedded system of support for the constructed domestic and international diversity of the student body and deliberately promotes the strong internal identification of those students as fully vested members of an inclusive community, those characteristics may explain why race did not play a greater role in the model.

Some research on pre-college populations and gender differences has indicated that non-cognitive factors may affect performance in female students (Fischer, Schult, & Hell, 2013a; Duckworth et al., 2015). Lower self-concept and reduced self-discipline has been found to

negatively affect intermediate and high school age females (McGraw et al., 2006) and self-discipline, rather than motivation for success, has been found to better predict grades for females of pre-college educational age (Duckworth et al., 2015). In the context of this research study, the results indicate that the strength of the predictive ability of measurements such as the SSAT on intermediate or high school age female students may significantly outweigh other potential non-cognitive factors. As such, standardized measurements may have enough significant predictive ability for secondary school admission practice to rely upon them as a selection tool without the under-predicting the achievement of females.

Research investigating non-cognitive variables and their potential role predicting academic achievement in secondary schools has examined self-control in conjunction with overall cognitive ability, demonstrating self-control as a significant factor predicting success beyond ability alone (Hofer, Kuhnle, Kilian, & Fries, 2012). And, in studies that examine Five-Factor models and coping skills, life satisfaction and positive negative outlook simultaneously have found that coping mechanisms predict academic achievement beyond the prediction of the non-cognitive domains of the Five-Factor Model (MacCann, Lipnevich, Burrus, & Roberts, 2012). In the case of this research study, individual student characteristics or dispositions that could potentially affect students' academic achievement both positively or negatively (e.g., self-control, self-motivation, maturation/coping skills and/or other regulatory characteristics) may have been controlled, emphasized or regulated deliberately by the institution's educational structure and affected the results. In effect, the highly regulated study hall environment, the close supervision over academic study habits and the extensive academic support services found within the institution under examination may have lessened or mitigated the role that these non-

cognitive factors could have played had these support structures not been implemented so directly.

When the individual domains of the HEXACO: PI-R were examined singularly, only the domain of Conscientiousness was found to be a significant predictor, with the beta shown to be negative. All other domains failed to contribute significantly to the model for predicting academic success. As the description of the HEXACO domain of Conscientiousness includes individuals who are organized, disciplined and who “strive for...perfection in their tasks” (Ashton & Lee, 2004, p. #), it suggests perfectionism may play an explanatory role in this academic setting and may have been a confounding factor interfering with academic performance. The influence of perfectionism in academic settings has been found to predict different forms of procrastination leading to lower achievement (Burnam, Komarraju, Hamel, & Nadler, 2014). Additionally, research that examined perfectionism in both general education students and students in the highly rigorous International Baccalaureate educational program has shown a correlation between perfectionism and lower achievement as measured on GPA (Shaunessy, Suldo, & Friedrich, 2011). Adolescents with perfectionist stress were found to need coping mechanisms to avoid negative impact on academic achievement (Nounopoulos, Ashby & Gilman, 2006), with research further suggesting perfectionist tendencies may be related to academic dishonesty in students (Krone, Rouse, & Bauer, 2012).

Research examining specific definitions of facet level traits versus domain level traits suggest that narrower definitions of the supporting characteristics within the larger domain may show greater validity in predicting academic success. When the domain of Conscientiousness from the NEO-PI-R (Ashton & Lee, 2004) was further broken down into four distinct measures in a study of almost 500 undergraduates, the sub-facets within the domain were found to show

more predictive ability than the domain as a whole (Woo et al., 2015). Similarly, other recent research supports the use of the sub-facet level of specificity within the Conscientiousness domain for predicting academic success (Burks et al., 2014). When an earlier study was replicated and re-examined, researchers concluded that the sub-domains within a personality inventory were stronger predictors than the broader classification within that inventory (Paunonen & Ashton, 2001), confirming the earlier results of the study and suggesting that the more narrowly defined aspects of domains such as Conscientiousness would be stronger predictors than the domain as a whole (Paunonen & Ashton, 2013). In the context of this research study, these findings suggest that the non-significant domain level scales may be too broad or lack the required specificity to contribute to a model predicting academic success, especially with a population where the academic and personal characteristics may still be developing given their relative age.

Despite the considerations affecting the significance of the HEXACO domains as discussed above, when the results of this research study are examined, the significance of the SSAT sub-scores' relationship to cumulative GPA in this study supports the effectiveness of using SSATs for secondary school admission. More specifically, the results support the effectiveness of the SSAT in secondary admission for the prediction of academic achievement of the demographic sub-groups of females and non-White applicants in a selective secondary school population.

### **Implications for Practice and Future Research**

The findings in this research study suggest that the non-cognitive measurements found in the HEXACO: PI-R (Ashton & Lee, 2004) may not add to the predictive model for secondary school age populations when examined at the domain level. As admission procedures at any

level of education are an inexact science given the reliance on both qualitative and quantitative assessments simultaneously, admission practice requires inclusive and diverse selection methods for building as incoming cohort of students. This study sought to examine the usefulness of the HEXACO: PI-R as a selection tool for secondary school admissions. The results suggest that this personality instrument may not be an effective selection tool contributor, given the non-significant association between the HEXACO domains and the success indicator, GPA. However, these results did suggest that secondary school admissions professionals will find the SSAT a highly successful predictive tool of academic achievement for secondary students.

Similarly, while standardized tests such as the SAT, ACT, and SSAT are currently employed as factors potentially predicting academic achievement at the secondary and post-secondary level (NACAC, 2015; NAIS, 2015), other standardized tests that are not in widespread use such as the Collegiate Learning Assessment (CLA) or the College Work Readiness Assessment (CWRA) may be useful predictors of GPA and suggest avenues for future research on normed assessments and predicting academic achievement (CAE, 2016).

In examining the implications for future research and practice using these predictors, studies evaluating more granular, facet-level aspects of the HEXACO inventory may indicate specific personality traits potentially contributing to predicting student success. Domain-level characteristics may potentially be too broad and expansive by definition to delineate their predictive ability, while facet-level characteristics with narrower definitions may be more precise in assessing any predictive contribution. HEXACO facet-level traits that relate to non-cognitive characteristics such as grit (Duckworth & Seligman, 2007) may show a relationship to academic achievement, as many aspects of more narrowly defined non-cognitive factors that relate to the characteristics of self-discipline or self-control. Studies on college age populations that focus on

these related non-cognitive variants have found a relationship to academic achievement (Mansfield et al., 2009; Tangney et al., 2004; Wolfe & Johnson, 1995), although secondary school age populations may not have matured to embody the full scope of the characteristics of the domain. Critical analysis of admission procedures and psychometric standardized tests in post-secondary education has led to research on the prediction inconsistencies for various sub-groups within the college-bound population. Researchers have examined the use of standardized testing and found under-prediction of academic performance in women (Leonard & Jiang, 1999; Wynne, 2006) and mixed results for ethnic minority groups (Crouse & Trusheim, 1988; Ramist et al., 1994; Ting, 1998). While this research study examined race defined in a narrow, binary manner in the prediction model, narrower slicing of the demographic variables might give greater insight into the role non-cognitive factors play in sub-populations of secondary school age students.

Similarly, future research that examines other and narrower sub-populations within the secondary school cohort may provide additional information on predicting academic success. Studies examining the predictive ability of non-cognitive characteristics in college-age students have shown those characteristics to be effective predictors for first-generation students (Ting, 1998), thus research examining that particular sub-population in secondary-school age populations may contribute to the prediction model and admission practices at that level. Future research using the HEXACO domains on sub-populations such as student-athletes may also provide insight into and add to the secondary school prediction models for academic success, as non-cognitive research on student-athletes at the college level has shown predictive ability (Sedlacek & Adams-Gaston, 1992). As secondary school demographics continue to diversify internationally (NAIS, 2015; NCES, 2015; NACAC, 2015), future research examining the role



that non-cognitive characteristics such as are found in the HEXACO: PI-R (Ashton & Lee, 2004) may play in predicting academic performance in international students may also contribute to admission practice.

### **Limitations**

Limitations of the study involve factors related to the survey data, the generalizability of the population studied, and potential factors specific to the SSAT variable. Within the survey data, reporting bias/social desirability bias was a potential limitation, as respondents may have answered questions in the HEXACO: PI-R (Ashton & Lee, 2004) with answers suggesting favorable personal traits. The conditions of the survey ensured complete anonymity, however, potentially mitigating that particular limitation. In addition, the administration of the HEXACO: PI-R survey takes place yearly on the same day, under similar conditions, at the same time and is not lengthy (typically fifty minutes), mitigating any potential issues with the testing environment or survey fatigue.

As the racial and socio-economic demographic of the research sample is not fully representative of the general secondary school population in the United States, the results may not be generalizable outside of independent secondary schools. Overall, the race and gender demographics of independent schools may not match the demographics of public secondary school environments. Further, the socio-economic (SES) strata found in the institution studied likely does not match the majority of American secondary schools (NAIS, 2015; NCES, 2015), although the demographics of the sample are representative of those schools that are members of the NAIS (2015). In this study, race and gender were used as demographic control variables, although socio-economic status was not included as part of the prediction model. After careful consideration, the specific socio-economic characteristics of the student demographic suggested

either a bifurcated or bunched range within the variable that may have affected or obscured the results, thus SES was not used in this study. A further limitation concerns the student demographic in terms of the academic strength of individuals at the institution studied, as the average score on the SSAT suggests that the overall level of intellectual ability is likely not representative of secondary school populations as a whole. The total average SSAT of the 305 survey responders stood at 2162, a total that suggests the average student is above the 90th percentile of test takers globally (SSAT, 2013). Thus, a broader distribution of ability levels in a secondary school may produce a greater differential of performance when evaluated in combination with certain personality traits.

Similarly, an institutional mission strongly driven by a college preparatory environment may restrict the variation of educational performance. In this research study, over 99% of the survey responders attended a four-year, post-secondary institution after graduation, a narrow range suggesting a constricted band of behaviors, intended outcomes or long-term goal orientation. Institutions with a broader range of long-term outcomes such as military service, two-year college attendance, certificate programs or immediate entry into the workforce as part of the goal orientation may produce a broader range of responses when examined in combination with certain personality traits found in the HEXACO domains and may produce different levels of academic achievement. .

A lack of previous research using the SSAT is another limitation of the study. Little, if any, research has taken place regarding the internal reliability or predictive validity of the SSAT despite its ubiquity in independent school admission (SSATB, 2011). In the context of this research study, two factors somewhat mitigate this limitation. The use of the SSAT is common practice both among like institutions and in the schools in the nearby geographical area in

admission policy, so findings will be potentially generalizable within a similar population. The SSAT was also created to substantially mirror the SAT's role in college admission by the ETS in both format and in function (SSATB, 2011). The SAT has a long history of validity and reliability studies conducted both within ETS and by independent researchers, so while the SSAT has not been evaluated with the same scrutiny, the limitation is potentially lessened by the intentionally constructed relationship.

The study also assumes the variable of cumulative GPA to be relatively free of limitations such as external influences or mitigating factors that would cloud the data. The study makes the assumption that the range of GPAs is created naturally and a normal and consistent range of factors leading to that cumulative remains stable across the grade distribution. The study assumes that variation in performance is sufficiently random across the population, is relatively consistently tied to student ability and effort, and is not skewed by unknown individual or group differences that might inconsistently alter performance. An assumption exists that random or embedded grade inflation is not a factor in the institution, as well as that the grading standards which contribute to the cumulative GPA remain consistent across the various disciplines and across the grade levels. The GPA is not a weighted variable based on level of the course, so the possibility exists that differences in course rigor may affect cumulative GPA; however, few accelerated courses are available in the first two to three years of available coursework and the total election of advanced classes tends to fall within a narrow range given this institution's curricular constraints, mitigating this potential limitation.

Further, adolescent development suggests that individual personality traits may not be fully formed within the secondary school age group and thus affect the variance of academic achievement (Poropat, 2009), indicating that self-awareness or understanding of the personality

traits found in the Five-Factor Model or the HEXACO: PI-R (Lee & Ashton, 2004) within some adolescents may not be formed enough to be useful as predictors. The inventory's creators suggested that the HEXACO: PI-R is a valid measurement for adolescent populations if certain conditions are met (Ashton, 2013), potentially mitigating this limitation, although more research needs to be conducted for greater confirmation.

### **Summary and Conclusion**

The results of this research study indicate that the non-cognitive factors found within the HEXACO: PI-R domains yielded no contribution to the model designed to predict academic achievement in secondary school students as defined by high school GPA, save for a modest, but significant, contribution to the model from the domain of Conscientiousness. The sub-scores of the SSAT showed to have the strongest predictive relationship with GPA of all variables within the model, with the Quantitative sub-score exhibiting the strongest predictive relationship to GPA. Given these results, the admission policies used at the secondary school level and with similar populations to the institution studied may find their selection procedures for predicting academic success strengthened by using the scores on the SSAT as a leading factor. If educational institutions across all age-group levels and facets of higher education seek to diversify their populations or use alternate models for selection to highlight other attributes in their incoming cohort of students, non-cognitive characteristics may provide contributory aspects of a student's total candidacy; however, the prediction of academic success in like secondary school populations as a whole will find the SSAT as a significant predictor of academic achievement.

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**APPENDIX A: HEXACO: PI-R Domain Descriptions (Ashton & Lee, 2004)**

*Honesty-Humility:* Persons with very high scores on the Honesty-Humility scale avoid manipulating others for personal gain, feel little temptation to break rules, are uninterested in lavish wealth and luxuries, and feel no special entitlement to elevated social status. Conversely, persons with very low scores on this scale will flatter others to get what they want, are inclined to break rules for personal profit, are motivated by material gain, and feel a strong sense of self-importance.

*Emotionality:* Persons with very high scores on the Emotionality scale experience fear of physical dangers, experience anxiety in response to life's stresses, feel a need for emotional support from others, and feel empathy and sentimental attachments with others. Conversely, persons with very low scores on this scale are not deterred by the prospect of physical harm, feel little worry even in stressful situations, have little need to share their concerns with others, and feel emotionally detached from others.

*Extraversion:* Persons with very high scores on the Extraversion scale feel positively about themselves, feel confident when leading or addressing groups of people, enjoy social gatherings and interactions, and experience positive feelings of enthusiasm and energy. Conversely, persons with very low scores on this scale consider themselves unpopular, feel awkward when they are the center of social attention, are indifferent to social activities, and feel less lively and optimistic than others do.

*Agreeableness (versus Anger):* Persons with very high scores on the Agreeableness scale forgive the wrongs that they suffered, are lenient in judging others, are willing to compromise and cooperate with others, and can easily control their temper. Conversely, persons with very low scores on this scale hold grudges against those who have harmed them, are rather critical of

others' shortcomings, are stubborn in defending their point of view, and feel anger readily in response to mistreatment.

*Conscientiousness:* Persons with very high scores on the Conscientiousness scale organize their time and their physical surroundings, work in a disciplined way toward their goals, strive for accuracy and perfection in their tasks, and deliberate carefully when making decisions. Conversely, persons with very low scores on this scale tend to be unconcerned with orderly surroundings or schedules, avoid difficult tasks or challenging goals, are satisfied with work that contains some errors, and make decisions on impulse or with little reflection.

*Openness to Experience:* Persons with very high scores on the Openness to Experience scale become absorbed in the beauty of art and nature, are inquisitive about various domains of knowledge, use their imagination freely in everyday life, and take an interest in unusual ideas or people. Conversely, persons with very low scores on this scale are rather unimpressed by most works of art, feel little intellectual curiosity, avoid creative pursuits, and feel little attraction toward ideas that may seem radical or unconventional.

**APPENDIX B: HEXACO: PI-R 100 Question Inventory (Ashton & Lee, 2004)**

- 1 I would be quite bored by a visit to an art gallery.
- 2 I clean my office or home quite frequently.
- 3 I rarely hold a grudge, even against people who have badly wronged me.
- 4 I feel reasonably satisfied with myself overall.
- 5 I would feel afraid if I had to travel in bad weather conditions.
- 6 If I want something from a person I dislike, I will act very nicely toward that person in order to get it.
- 7 I'm interested in learning about the history and politics of other countries.
- 8 When working, I often set ambitious goals for myself.
- 9 People sometimes tell me that I am too critical of others.
- 10 I rarely express my opinions in group meetings.
- 11 I sometimes can't help worrying about little things.
- 12 If I knew that I could never get caught, I would be willing to steal a million dollars.
- 13 I would like a job that requires following a routine rather than being creative.
- 14 I often check my work over repeatedly to find any mistakes.
- 15 People sometimes tell me that I'm too stubborn.
- 16 I avoid making "small talk" with people.
- 17 When I suffer from a painful experience, I need someone to make me feel comfortable.
- 18 Having a lot of money is not especially important to me.
- 19 I think that paying attention to radical ideas is a waste of time.
- 20 I make decisions based on the feeling of the moment rather than on careful thought.
- 21 People think of me as someone who has a quick temper.
- 22 I am energetic nearly all the time.
- 23 I feel like crying when I see other people crying.
- 24 I am an ordinary person who is no better than others.
- 25 I wouldn't spend my time reading a book of poetry.
- 26 I plan ahead and organize things, to avoid scrambling at the last minute.
- 27 My attitude toward people who have treated me badly is "forgive and forget".
- 28 I think that most people like some aspects of my personality.
- 29 I don't mind doing jobs that involve dangerous work.

- 30 I wouldn't use flattery to get a raise or promotion at work, even if I thought it would succeed.
- 31 I enjoy looking at maps of different places.
- 32 I often push myself very hard when trying to achieve a goal.
- 33 I generally accept people's faults without complaining about them.
- 34 In social situations, I'm usually the one who makes the first move.
- 35 I worry a lot less than most people do.
- 36 I would be tempted to buy stolen property if I were financially tight.
- 37 I would enjoy creating a work of art, such as a novel, a song, or a painting.
- 38 When working on something, I don't pay much attention to small details.
- 39 I am usually quite flexible in my opinions when people disagree with me.
- 40 I enjoy having lots of people around to talk with.
- 41 I can handle difficult situations without needing emotional support from anyone else.
- 42 I would like to live in a very expensive, high-class neighborhood.
- 43 I like people who have unconventional views.
- 44 I make a lot of mistakes because I don't think before I act.
- 45 I rarely feel anger, even when people treat me quite badly.
- 46 On most days, I feel cheerful and optimistic.
- 47 When someone I know well is unhappy, I can almost feel that person's pain myself.
- 48 I wouldn't want people to treat me as though I were superior to them.
- 49 If I had the opportunity, I would like to attend a classical music concert.
- 50 People often joke with me about the messiness of my room or desk.
- 51 If someone has cheated me once, I will always feel suspicious of that person.
- 52 I feel that I am an unpopular person.
- 53 When it comes to physical danger, I am very fearful.
- 54 If I want something from someone, I will laugh at that person's worst jokes.
- 55 I would be very bored by a book about the history of science and technology.
- 56 Often when I set a goal, I end up quitting without having reached it.
- 57 I tend to be lenient in judging other people.
- 58 When I'm in a group of people, I'm often the one who speaks on behalf of the group.
- 59 I rarely, if ever, have trouble sleeping due to stress or anxiety.



- 60 I would never accept a bribe, even if it were very large.
- 61 People have often told me that I have a good imagination.
- 62 I always try to be accurate in my work, even at the expense of time.
- 63 When people tell me that I'm wrong, my first reaction is to argue with them.
- 64 I prefer jobs that involve active social interaction to those that involve working alone.
- 65 Whenever I feel worried about something, I want to share my concern with another person.
- 66 I would like to be seen driving around in a very expensive car.
- 67 I think of myself as a somewhat eccentric person.
- 68 I don't allow my impulses to govern my behavior.
- 69 Most people tend to get angry more quickly than I do.
- 70 People often tell me that I should try to cheer up.
- 71 I feel strong emotions when someone close to me is going away for a long time.
- 72 I think that I am entitled to more respect than the average person is.
- 73 Sometimes I like to just watch the wind as it blows through the trees.
- 74 When working, I sometimes have difficulties due to being disorganized.
- 75 I find it hard to fully forgive someone who has done something mean to me.
- 76 I sometimes feel that I am a worthless person.
- 77 Even in an emergency I wouldn't feel like panicking.
- 78 I wouldn't pretend to like someone just to get that person to do favors for me.
- 79 I've never really enjoyed looking through an encyclopedia.
- 80 I do only the minimum amount of work needed to get by.
- 81 Even when people make a lot of mistakes, I rarely say anything negative.
- 82 I tend to feel quite self-conscious when speaking in front of a group of people.
- 83 I get very anxious when waiting to hear about an important decision.
- 84 I'd be tempted to use counterfeit money, if I were sure I could get away with it.
- 85 I don't think of myself as the artistic or creative type.
- 86 People often call me a perfectionist.
- 87 I find it hard to compromise with people when I really think I'm right.
- 88 The first thing that I always do in a new place is to make friends.
- 89 I rarely discuss my problems with other people.

- 90 I would get a lot of pleasure from owning expensive luxury goods.
- 91 I find it boring to discuss philosophy.
- 92 I prefer to do whatever comes to mind, rather than stick to a plan.
- 93 I find it hard to keep my temper when people insult me.
- 94 Most people are more upbeat and dynamic than I generally am.
- 95 I remain unemotional even in situations where most people get very sentimental.
- 96 I want people to know that I am an important person of high status.
- 97 I have sympathy for people who are less fortunate than I am.
- 98 I try to give generously to those in need.
- 99 It wouldn't bother me to harm someone I didn't like.
- 100 People see me as a hard-hearted person.

## APPENDIX C: Liberty University IRB Exemption Letter



The Graduate School at Liberty University

April 12, 2013

XXXXXXXXXXXXXXXXXXXX

IRB Exemption 1587.041213: Predicting High School GPA Using Hexaco  
Personality Domains and the Secondary School Admission Test

Dear xxxxxxxx,

The Liberty University Institutional Review Board has reviewed your application in accordance with the Office for Human Research Protections (OHRP) and Food and Drug Administration (FDA) regulations and finds your study to be exempt from further IRB review. This means you may begin your research with the data safeguarding methods mentioned in your approved application, and that no further IRB oversight is required.

Your study falls under exemption category 46.101 (b)(4), which identifies specific situations in which human participants research is exempt from the policy set forth in 45 CFR 46:

(4) Research involving the collection or study of existing data, documents, records, pathological specimens, or diagnostic specimens, if these sources are publicly available or if the information is recorded by the investigator in such a manner that subjects cannot be identified, directly or through identifiers linked to the subjects.

Please note that this exemption only applies to your current research application, and that any changes to your protocol must be reported to the Liberty IRB for verification of continued exemption status. You may report these changes by submitting a change in protocol form or a new application to the IRB and referencing the above IRB Exemption number.

If you have any questions about this exemption, or need assistance in determining whether possible changes to your protocol would change your exemption status, please email us at [irb@liberty.edu](mailto:irb@liberty.edu).

Sincerely,

*Professor, IRB Chair*



*Liberty University | Training Champions for Christ since 1971*

## Appendix D: Email Correspondence for Permission to Publish

### RE: Permission to Publish

Michael Ashton [via](mailto:via_brocku.onmicrosoft.com) brocku.onmicrosoft.com

Hi Jeffrey,

You hereby have permission to reproduce the domain descriptions and the contents of the HEXACO-PI-R inventory questions in the appendix of your dissertation.

Please include the following statement: (C) 2009 Kibeom Lee and Michael C. Ashton. Reprinted with permission.

If you need any further information, please just let me know.

Sincerely,  
Mike Ashton

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From: Jeffrey Durso-Finley [[jdfinley@lawrenceville.org](mailto:jdfinley@lawrenceville.org)]  
Sent: May 25, 2016 5:23 PM  
To: Michael Ashton  
Subject: Re: Permission to Publish

Good afternoon...

My apologies for bothering you again.

The university has asked me to reach out to you once again as they have specific language about placing dissertations and material on their "Digital Commons," which is basically a digital archive for future graduate students.

I asked them for specific language and they sent me this as a template.

"My program affords me the opportunity of publishing my thesis in the Liberty University open-access repository of scholarship (Digital Commons). They have required proof of permission for me to reproduce the domain descriptions and the contents of the HEXACO-PI-R Inventory question in the appendix of my dissertation. May I have your permission to do this? I will be sure to provide attribution to point readers to the instrument."

I think you covered this previously by email, but they are quite attentive to this (in the end, not a bad characteristic to have :-)) and so I have agreed to email you again.

Thanks much - sorry for the bother.

JDF