

NAVAL POSTGRADUATE SCHOOL

Monterey, California



THESIS

**THE UTILITY OF PERSONALITY MEASURES IN THE
ADMISSIONS PROCESS AT THE UNITED STATES
NAVAL ACADEMY**

by

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June 2002

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ABSTRACT

This study examined the ability of three personality measures to predict midshipmen attrition at the United States Naval Academy. More specifically, the study examined the ability of the Myers-Briggs Type Indicator and the Personal History Questionnaire to replace the Career Interest Score of the Strong Interest Inventory in the Naval Academy admissions formula and to better predict overall, voluntary, academic, and performance/conduct attrition. The data used were from the Naval Academy classes of 1995 to 2000. Logistic regression analysis was done using just the classes of 1995-1999. The class of 2000 was used in an out of sample prediction to test the validity of the study's attrition model. Results showed that the Career Interest Score is unable to predict attrition. Additionally, the addition of the MBTI and PHQ improved the predictive ability of the admissions formula for two of the four attrition variables modeled. The model was most effective in predicting voluntary attrition. Recommendations are made regarding the United States Naval Academy admissions policy and for future research in the subject area.

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I. INTRODUCTION

A. BACKGROUND

Every year the United States Naval Academy awards approximately 1,500 appointments to the best applicants from a pool of over 12,000 people. The Naval Academy Admissions Board relies on an index called the Whole Person Multiple to rank the applicants. The Multiple is computed from the applicant's high school performance data, teacher's recommendations, demographic data and personality data (Black, 2001). The use of personality data, in the form of the Strong Interest Inventory (SII), makes the Naval Academy's admission system unusual among educational institutions.

When the Naval Academy Office of Admissions receives an admissions package, they convert the applicant's responses to numeric values. These values are then entered into a formula that calculates the Whole Person Multiple. The Multiple value is then used to place applicants in a ranked order. Each applicant file enters the Admissions Board review process with this value attached. The board then reviews the applicant's file to determine if they represent a "good fit for military service" (Black, 2001) and have the academic ability to graduate from the U. S. Naval Academy.

The Office of Admissions is always looking for ways to improve the admissions process. One measure of an improved admissions process is reduced attrition. Attrition at the Naval Academy can be grouped into three major categories: Voluntary Attrition, Academic Attrition and Performance/Conduct Attrition. This thesis will examine the correlation between personality (as defined by the SII, the Myers-Briggs Type Indicator (MBTI), and the Personality History Questionnaire (PHQ)) and attrition.

Only a small portion of the 12,000 applicants in the applicant pool present the Admissions Board with easy decisions each year. Those tend to be the extremely qualified and unqualified candidates. The number of qualified applicants comprising the middle of the distribution always outnumber the available appointments. The board uses the tools available and their experience to select the best from that group. This thesis will provide the Admissions Board with a detailed understanding of Naval Academy attrition.

This knowledge will assist board members in making the best possible decisions about future applicants.

B. PURPOSE

The purpose of this research is to increase the Superintendent's knowledge of midshipmen attrition at the United States Naval Academy and to provide the Naval Academy Admissions Board with additional empirical data to assist them in selecting the highest quality applicants from the applicant pool. Research includes an analysis of three personality measures: the SII Career Interest Score (CIS), the MBTI, and PHQ. The study evaluates each personality measure's ability to act as a predictor of specific types of attrition from the Naval Academy.

C. RESEARCH QUESTIONS

This thesis examines the following research questions:

1. Does the use of personality measures improve the Admission Board's ability to identify candidates who are likely to attrite from the United States Naval Academy and therefore, assist them in selecting those candidates who will persist through the four-year program?
 - a. Would the addition of the Myers-Briggs Type Indicator in place of the Career Interest Score of the Strong Interest Inventory improve the Whole Person Multiple's ability to predict voluntary, academic, and performance/conduct attrition from the U.S. Naval Academy?
 - b. Would the addition of the Personal History Questionnaire in place of the Career Interest Score of the Strong Interest Inventory improve the Whole Person Multiple's ability to predict voluntary, academic, and performance/conduct attrition from the U.S. Naval Academy?

D. SCOPE

The chief limitation of this study is a result of limited data availability. Specifically, the attrition variables and MBTI variables used in the statistical model were only available for applicants who actually entered the Naval Academy. Therefore, the data set contains only those candidates who were offered and accepted appointments (arrived for Plebe Summer) to the Naval Academy from class years 1995-2000. It does

not address the remainder of the applicant pool.¹ Therefore, generalizations to future applicant pools must be made with caution. The findings can be generalized to all applicants if the reader is willing to make the assumption that the relationship between personality measures (MBTI & PHQ) and attrition is the same for those who entered the Naval Academy as it is for those who did not.

E. ORGANIZATION OF THESIS

This thesis is divided into five chapters. Chapter II is a review of the current literature pertaining to the Naval Academy admissions system, college student attrition, Naval Academy attrition, the SII, the MBTI, and the PHQ. Chapter III provides a description of the data set, the research methodology, and the variables used in the model. Chapter IV presents the results of the data analysis. Chapter V provides the reader with responses to the research questions, additional conclusions and suggestions for further research.

¹ The remainder of the applicant pool is comprised of those applicants who were not offered an appointment, or those applicants who were offered an appointment but chose not to attend the Naval Academy.

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II. LITERATURE REVIEW

The purpose of this chapter is to provide the reader with a review of the literature that serves as the backbone of the study. Specifically, the chapter will explain the Naval Academy admissions system, discuss a model for college student attrition, define and explain the three major forms of Naval Academy attrition, and discuss the literature pertaining to the three personality measures used in the study.

A. U.S. NAVAL ACADEMY ADMISSIONS

The Naval Academy admissions system serves as the impetus for this study. The majority of the analyzed data is drawn directly from the admissions process and any conclusions drawn from the study are meant to assist the Office of Admissions in improving the overall admissions system. In order to understand why the statistical model is structured as it is, it is important to understand the Naval Academy's admissions system and the data and processes used therein.

1. Mission and Objectives

The mission of the United States Naval Academy Office of Admissions is to:

Ensure that the best-qualified students from around the United States and its territories are selected for admission and that these young men and women have the drive and motivation to complete the four-year program and excel as Navy and Marine Corps officers. (USNA Catalog, 2002, p. 17)

This mission makes the Naval Academy Admissions process unusual among undergraduate institutions. Most public and private institutions select applicants based on their ability to perform well academically, enhance the characteristics of the student body, and contribute to the institution's professional reputation. Additionally, these institutions accept applicants to all four classes (freshmen through senior) in order to preserve bottom line profits, which are threatened by student body attrition. The Naval Academy is also looking for candidates who have the ability to excel academically, enhance the characteristics of the student body, and contribute to the reputation of the institution. The institution's mission however, forces the Office of Admissions to select

individuals using a different paradigm.² Every candidate they appoint is not just a student; he or she is a future employee. Every graduate enters the same work force, the U. S. Naval Service. It is the responsibility of the Office of Admissions to ensure candidates selected for appointment are the most qualified to succeed academically and most likely to commit to a career of Naval Service.

In an attempt to comply with their mission, the Naval Academy Office of Admissions measures every candidate against a specific set of personal standards. They ensure every candidate selected for admission has the following qualities, attributes, and capabilities (Black, 2001).

- Applicants must be mentally and physically able to undertake the rigorous academic, professional education as well as physical training programs
- He or she must show an interest in serving his or her country as a professional officer in the Naval Service
- He or she must show an interest in, and potential to succeed in, fields of study that reflect the needs of the Navy and Marine Corps
- He or she must show potential for leadership in the Naval Service
- He or she should have the capacity and desire to complete the four-year course and remain in the Service beyond the period of obligated service after commissioning
- He or she must be of good moral character
- As a whole appointees should represent women and minorities in appropriate numbers in support of the Equal Opportunity Program of the Department of the Navy
- He or she should be likely to complete the Naval Academy Program and successfully serve as an officer in the U.S. Navy or Marine Corps.

2. Eligibility

The Naval Academy Admissions process is based on a three-tiered eligibility system. Each tier assists the Naval Academy Office of Admissions in filtering out non-qualified individuals from the applicant pool. Tier One's (Contact Tier) purpose is to ensure every individual seeking entrance meets a set of basic eligibility requirements.

² The information presented in this section is gleaned from the *United States Naval Academy Catalog*, the Naval Academy Admissions web site, and Mrs. Louise Black, an employee of the U.S. Naval Academy Information Technology Services Division. Mrs. Black is the organizational expert on the Admissions Information System (AIS) and has written multiple documents describing how it supports the Naval Academy Admissions process.

Only after meeting all of these requirements will the Naval Academy Office of Admissions consider these individuals as qualified applicants and forward them a Preliminary Application and Pre-Candidate Questionnaire (PCQ) (Black, 1999). Second Tier (Prospective Midshipman Tier) requirements continue the selecting out process for non-qualified applicants. The Office of Admissions uses each applicant's responses to the Pre-Candidate Questionnaire and their ability to comply with the remaining second tier requirements to determine the strength of each applicant's record. If their record is strong enough, they become an official candidate for admission. Once designated, each candidate must then comply with the third and final level of requirements. These requirements include obtaining a nomination, passing the Physical aptitude Examination, interviewing with a Naval Academy Blue & Gold Officer, and successfully completing a Department of Defense Medical Evaluation Review Board (DoDMERB) physical examination. After successfully completing these Tier Three (Candidate Tier) requirements, the candidate's file is complete. The Admissions Board reviews each file, determines if the candidate is qualified, and offers an appointment or rejection. The final decision of attendance lies in the hands of those actually offered appointments. Each year 200 to 300 applicants do not accept appointments to the Naval Academy (Black, 1999).

The eligibility requirements for all three admissions tiers are listed below (USNA Catalog, 2000).

Tier 1. Contact Tier - Basic Eligibility

1. Prospective applicants must be United States citizens.
2. Prospective applicants must be individuals of good moral character.
3. Prospective applicants must be at least 17 years of age and no older than 23 years of age on the 1st of July of the year they would enter the academy.
4. Prospective applicants must not be married.
5. Prospective applicants cannot be pregnant.
6. Prospective applicants must have no legal obligation to support a child, children, or other individual.

Tier 2. Prospective Midshipman Tier - Intermediate Requirements

1. Applicants must possess or obtain a social security number.
2. Applicants must complete and submit a Preliminary Application
3. Applicants must obtain one or more nominations.
4. Applicants must take the SAT or ACT college admissions test.

Tier 3. Candidate Tier - Advanced Requirements

1. Candidates must complete and submit a candidate application packet.
2. Candidates must take the Department of Defense Medical Evaluation Review Board (DoDMERB).
3. Candidates must take the Physical Aptitude Examination (PAE).
4. Candidates must interview with a Naval Academy Information Officer (Blue & Gold Officer) in their local area.

3. Application Process

Applicants may contact the Naval Academy as early as the ninth grade. These individuals will receive periodic mailings from the Admissions Department and can begin to meet the basic requirements for admission. The earliest an individual can apply for admission to an incoming class is January of their junior year. The latest a person can officially apply is March 1st of their senior year (Black, 2001). The admissions website recommends applying between April (junior year) and January (senior year). The Admissions Board begins evaluating and selecting candidates on April 1st of the year prior to induction.

Once a prospective applicant meets the basic eligibility requirements (Tier One) and is within the prescribed time frame for admission, they are mailed a Pre-Candidate Packet. The most important item in the packet is the Pre-candidate Questionnaire (PCQ). Returning a completed PCQ automatically starts an admissions file for that individual. This also upgrades their status from Contact to Prospective Midshipman in the Admissions database (Black, 2001).

After submitting the Pre-Candidate Questionnaire, Prospective Midshipmen continue to satisfy Tier Two requirements. Admissions staff continuously review applicant files to determine if individual applicants have met the requirements to be

upgraded from Prospective Midshipman to Candidate status. This status upgrade occurs when two criteria are met. First, the Admissions staff member has to believe the applicant's PCQ reflects a strong enough record to make him or her a competitive candidate. Second, the applicant's officially reported SAT or ACT scores must meet or exceed the minimum values for admission (530 SAT Verbal , 570 SAT Math) (Black, 2001).

Once an applicant is upgraded to candidate status, he or she must complete any remaining Tier Two requirements and begin to schedule Tier Three requirements. The two major Tier Three requirements are the Physical Aptitude Exam (PAE) and the DoDMERB Medical screening. Once a candidate is qualified medically, physically, and academically, he or she can begin seeking a nomination (USNA Catalog, 2002).

The nomination process is the last major milestone prior to review by the Admissions Board. There are a variety of official nominating sources. The most common type of nomination is the Congressional nomination. Candidates can apply for nomination from any of their three Congressmen (1 Representative and 2 Senators). Each congressman may award ten nominations. Other nomination sources include the President and the Vice President. Presidential nominations are reserved for the children of career military officers and enlisted personnel. The President can award an unlimited number of nominations, but only one hundred Presidential nominees may receive appointments each year. The Vice President is only authorized to award five nominations each year. His nominations are usually reserved for applicants who are United States citizens but live outside the continental United States. There are specific nomination quotas set aside for special case applicants. These include members of the regular and reserve Navy and Marine Corps, Naval Reserve Officers Training Corps, Children of Medal of Honor awardees, children of deceased or disabled veterans, children of Prisoners of War, and children of Servicemen Missing in Action (USNA Catalog, 2002). Once a nomination is secured, the candidate's file is complete.

The final step in the application process is consideration of the candidate's file by the Admissions Board. On average, the Naval Academy Office of Admissions receives ten to twelve thousand applications every year. Of those, approximately three thousand

applicants are deemed academically qualified. This number is further reduced to approximately two thousand applicants once physical and medical screenings are completed. Of those two thousand applicants who are academically, physically, and medically qualified, approximately fifteen hundred will receive an appointment. Twelve to thirteen hundred of those applicants will accept the appointment and join the incoming class (Black, 2001).

4. Whole Person Multiple

The Whole Person Multiple is derived from candidates' admissions information. Admissions Board members use the multiple as a reference point and a comparison to evenly judge a candidate's qualifications. The Whole Person Multiple is designed to be a predictor for successful completion of freshman/Plebe year.

The Whole Person Multiple is a numeric assessment of a candidate's record. It is based only on the official information received about each candidate. Qualifying candidate multiples range from 58,000 to over 80,000 points. The multiple is a weighted computation and the primary metric used by the Admissions Board. The components of the multiple and their weights are listed below (Black, 2001).

- Rank in High School Class (21%)
- Highest standardized SAT or ACT test score for Math (31%)
- Highest standardized SAT or ACT test score for English (15%)
- Combined Recommendation of School Official (RSO) - Math & English³ (8%)
- Combined Athletic and Non-Athletic Extra Curricular Activities (10%)
- Strong Interest Inventory (SII) Technical Interest Score (TIS) (12%)
- Strong Interest Inventory (SII) Career Interest Score (CIS) (3%)

5. Admissions Board

The Naval Academy Admissions Board meets every Thursday from 0800 to 1600. At the end of August, the Board conducts what is known as an Early Board. The Early Board is a practice board. At this meeting, the board reviews cases, discusses the Superintendent's class profile outline, and indoctrinates new board members. Regular

³ Commanding Officer's complete this form for prior enlisted candidates.

Board meetings start in October and extend through April. Their goal is for applicants to receive acceptance, declination or alternate offers by the 15th of April.

Admissions Board members have the ability to award plus or minus points to a candidate's Whole Person Multiple score. These point additions are known as the Recommendation of the Admissions Board or RABs. This is only done if the candidate's whole person multiple does not "accurately reflect their potential and motivation to succeed in a career in the Naval Service." According to the Superintendent, RAB scores must remain in the -500 to +9000 point range. RABs above 10,000 require approval from the Superintendent. Approximately 75 to 85% of each incoming class is awarded a RAB.

Admissions Board membership is a three-year commitment. Any of the four division directors are eligible to chair the Admissions Board. The Board members are listed below (Black, 2001).

1. Director, Division of Mathematics and Science
2. Director, Division of Humanities and Social Sciences
3. Director, Division of Engineering and Weapons
4. Director, Division of Professional Development
5. One professor from the following groups or departments:
 - Group I Majors (Engineering)
 - Group II Majors (Math/Sciences)
 - Group III Majors (Humanities)
 - Division of Professional Development
 - Academic Center
6. One Battalion Officer
7. One Company Officer
8. Commandant's Ethics Officer
9. Dean of Admissions
10. Director of Admissions
11. Senior Medical Officer
12. Assistant Director of Athletics
13. Associate Director of Admissions

B. ATTRITION

As stated in the previous section, one of the Naval Academy Office of Admission's goals is to only offer appointments to those candidates who will successfully complete the four-year program. The first step in gaining the ability to identify these candidates must lie in a study and understanding of why college students leave undergraduate institutions. Only after admissions policy makers have a thorough understanding of the forces behind attrition can they begin to discuss and develop a Naval Academy Attrition model. Vincent Tinto's Student Integration Model is arguably the most influential model in the field of college student attrition. It serves as the basis for many of the decisions made in constructing the attrition model. The following paragraphs explain Tinto's model, attrition at the U.S. Naval Academy, and the relationship between them.

1. Tinto's Student Integration Model

Vincent Tinto's work is accepted as the basis for the modern study of college attrition. He uses Dutch anthropologist, Arnold Van Gennep's study of the rites of passage in tribal societies to describe a student's transition from high school to college. Van Gennep submits there are three stages an individual must go through to successfully transition from one society to another (Tinto, 1993). Tinto argues that the unsuccessful navigation of these three stages -- separation, transition, and incorporation -- result in the "early stages of withdrawal from institutions of higher education" (1993, p.95). He also argues that students likely to depart are unable to: separate from their old communities (family and high school), navigate the uncertainty of the transition phase, and identify and incorporate the behavioral norms of the collegiate environment.

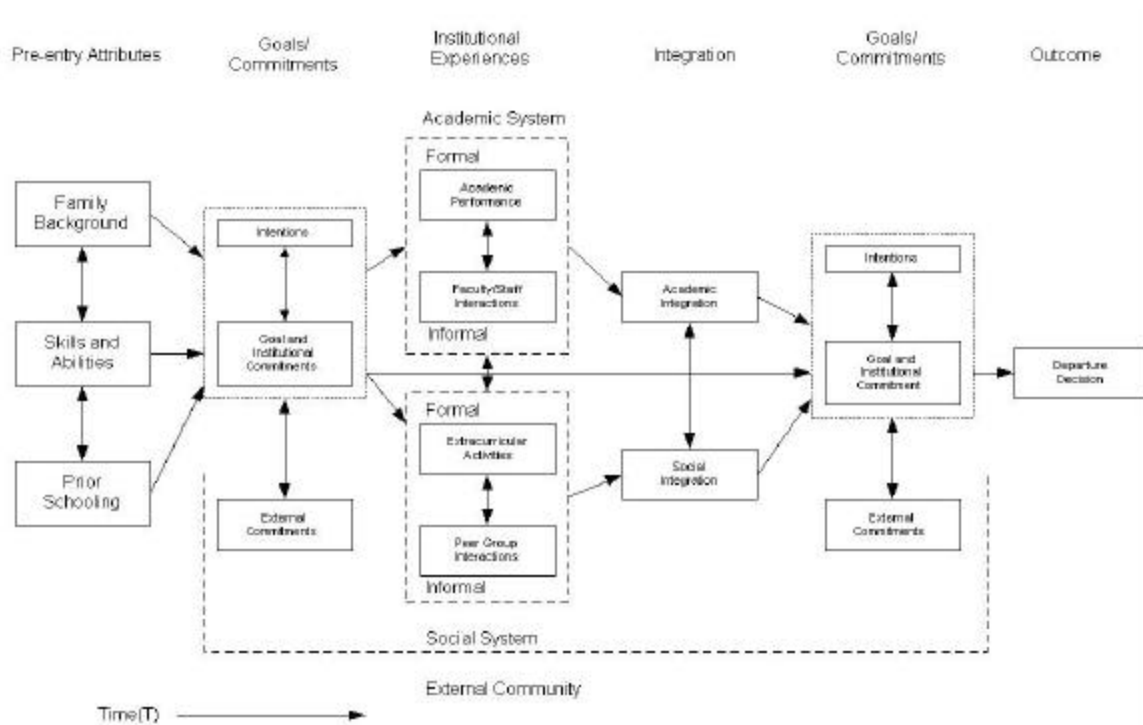
Tinto believes that every student needs to achieve some level of social and intellectual integration into the college community in order to persist. This level of integration varies from student to student due to the demographic differences and inconsistencies in external factors experienced by each student. Success is achieved when there is a good "fit" between the student and the institutional environment (Pascarella, Terenzini, & Wolfle, 1986).

Tinto combines Van Gennep's three-stage theory and his own theory of social and intellectual integration in his longitudinal model of institutional departure. In his book, *Leaving College: Rethinking the Causes and Cures of Student Attrition*, Tinto states:

Individual departure from institutions can be viewed as arising out of a longitudinal process of interactions between an individual with given attributes, skills, financial resources, prior educational experiences, and dispositions and other members of the academic and social systems of the institution. The individual's experience in those systems, as indicated by his/her intellectual and social integration continually modifies his or her intentions and commitments. (1993, p. 113)

More simply stated, given an individual's characteristics and pre-dispositions coming into a college environment, positive experiences (those which increase academic or social integration) reinforce persistence by strengthening the individual's commitment to graduating and to the institution of which they are becoming a member. As a student's level of social and academic integration (success) increases, their commitment to the institution and graduation increases. The stronger a student's commitment, the more likely he or she will persist. Figure 1 below depicts Tinto's Longitudinal Model of Student Departure.

Figure 1. Tinto's Longitudinal Model of Student Departure



Although Tinto's model was created to address student departure from traditional undergraduate institutions, it can be applied to the unique social and intellectual environment that exists at the Naval Academy. The Naval Academy carefully attempts to reduce attrition through its selection of candidates' *pre-entry attributes* and through its structuring of *institutional experiences*. Due to the selectivity inherent to the admissions system, most candidates' *pre-entry attributes* are excellent. The admissions system measures and controls for *skills and abilities* and *prior schooling*. Midshipmen entering the Naval Academy are required to have outstanding academic, social, and physical abilities. The admissions system addresses *family background* to a lesser degree than *skills and abilities* and *prior schooling*. Survey questions pertaining to the parent's marital status, education level, and income; and questions pertaining to a candidate's behavioral history are used to make general assumptions about a candidate's family history.

The *goals and commitments* section of Tinto's model is also applicable to the Naval Academy. As stated in the last paragraph, the Naval Academy admissions system is designed to measure a candidate's initial commitment. In addition, midshipmen tend to be highly motivated and goal oriented people. Their *intentions* tend to align with the intentions of the institution. Additionally, their *goals* tend to closely align to the institution's goals. Their *institutional commitments* are high. They are expected to perform well academically, are required to participate in an organized sport (varsity, club or intramural), are expected to meet their professional development obligations, and are highly encouraged to get involved with one or more of the many extra-curricular activities available to them.

The Naval Academy also attempts to reduce any *external commitments* that might undermine a midshipman's *institutional commitments*.

The *institutional experiences* section of Tinto's model addresses the student's interactions within the academic and social systems of the institution. Tinto suggests that the more successful a student's *academic performance* and *extracurricular performance*, the less likely they are to depart. A lack of performance academically, or otherwise, accounts for a large portion of attrition at the Naval Academy. Tinto also suggests that a

high level of *faculty/staff interaction* and *peer group interaction* can prevent a departure decision even when a student does not meet with success academically or otherwise. The Naval Academy goes to great lengths to infuse faculty and staff into every aspect of the midshipmen's life and encourages involvement in extracurricular activities to ensure each midshipman is able to interact with various staff/faculty members and multiple peer groups in various settings. This forced integration helps the midshipman create relationships and support groups that make departure less appealing even when they are struggling academically or otherwise.

2. U. S. Naval Academy Attrition

Approximately eight out of ten midshipmen complete their four years and go on to active duty Naval Service. Midshipmen who attrite from the Naval Academy do so for many different reasons. When they leave, each midshipman is assigned one of 28 different attrition codes. These codes can be categorized into four general areas. The four basic forms of attrition are voluntary attrition, academic attrition, performance/conduct attrition, and physical disqualification/death. This study focuses on the first three forms of attrition. On average approximately 15% of midshipmen attrite voluntarily, 4% attrite for academic reasons, and another 3 % attrite for performance or conduct issues.⁴

a. Voluntary Attrition

Voluntary attrition at the Naval Academy occurs for many of the same reasons Tinto cites in his longitudinal model of student attrition. Students who are unable to adjust and integrate into the Naval Academy's academic and social lifestyle are at risk to attrite. The impact of integration is even greater for those students who are already at risk to depart than it is for those students who meet with initial academic or social success (Provost, 1985). The categories of Tinto's model that best explain voluntary attrition at the Naval Academy are *family background*, *intentions*, *goals*, and *external commitments*. If a midshipman's *family* does not value education, looks down upon military service, does not support their child, or has other problems that distract the midshipman from integrating into the academic and social environment at the Naval Academy, then that midshipman is at risk to attrite voluntarily. Midshipmen seem to be most at risk when

⁴ Attrition percentages based on attrition data obtained from the Naval Academy classes of 1995-2000.

distractions occur early in the four-year program when the academic adjustment is extremely difficult and social interactions have not yet developed into a strong support network. Midshipmen whose *intentions* or *goals* do not align with the goals and mission of the institution are also at risk to attrite voluntarily. Many of these midshipmen accept a nomination with an uninformed expectation of what midshipman life is like or may decide as they learn more about the Naval Service that they made the wrong decision. Some only accept an appointment due to pressure from their parents. Eventually, these midshipmen figure out that their intentions and goals are not in alignment with the institutions and they depart. Finally, excessive *external commitments* as a result of financial difficulty, or unique family situations can provide enough distraction to prevent academic and social integration and cause a decreased commitment to graduation. Some midshipmen who find themselves in these types of situations decide that being at the Naval Academy is actually preventing them from handling some external commitment so they depart.

There are additional situations, specific to the Naval Academy that may contribute to voluntary attrition. Midshipmen incur an active duty service obligation if they stay enrolled beyond their sophomore year. Depending on what a graduate elects to do in the Navy or Marine Corps, a graduate will incur an obligation to serve on active duty for a period of five to ten years. This reality is something unique to service academies and clearly plays a major part in students' decisions to persist.

Although academic attrition is its own category, the highly demanding academic course load thrust upon each midshipman can be a major contributor to voluntary attrition. Midshipmen who struggle academically are often required to attend summer school. Certainly this has a compounding affect on those that are struggling especially in their first or second year, and prior to their shouldering a lengthy service obligation. At times the combined challenges of life at a service academy are too demanding for some to handle.

b. Academic Attrition

The categories of Tinto's longitudinal model that most directly address academic attrition from the Naval Academy are the *skills and abilities*, *prior schooling*,

academic performance, academic interaction, and faculty/staff interaction variables. Students who do not possess the study habits, knowledge base or prior schooling required to succeed at the Naval Academy have a difficult time completing the four-year program. Students who arrive and encounter difficulty academically tend to have trouble in other areas due to the time and effort they must expend to improve their academics. Dr. Paul Roush explained the affects of poor academic performance in his article, *MBTI Type and Voluntary Attrition at the United States Naval Academy*. He states:

Academic performance is a crucial component in the stress equation under which Midshipmen must operate. The Plebe Midshipman whose grades are good has more time available to prepare for professional, i.e., military-related requirements and activities. Consequently, he or she is more likely to be praised by the upper class. Failure to perform adequately in the professional realm invites prompt attention from upper class and may well result in increased stress and lowered self-esteem of the Plebe. Thus, students achieving academic success should experience a lower rate of stress, higher self esteem, and probably a lower rate of voluntary resignation compared with those who experience significant academic difficulty. (Roush, 1989, p. 78)

Academic attrition tends to occur earlier in the four-year curriculum. The added stress and pressure of freshman/plebe year tends to bring weaknesses to the surface. Midshipmen are required to maintain and graduate with an academic average of "C" or better. Additionally, all the curricula at the Naval Academy are tightly sequenced and in lock step with the four-year degree program. Unlike civilian institutions where students can decide to lower their course load, Midshipmen must complete between fifteen and twenty-one semester hours during each of their eight semesters in order to accumulate the minimum of 140 semester hours required for graduation.

In an attempt to reduce academic attrition, the Naval Academy relies on a program called EI or Extra Instruction. Every professor is required to offer any midshipman who asks for it, one-on-one or small group extra instruction sessions. All of the required, core, technical courses (Physics, Chemistry, Electrical Engineering) have evening extra instruction sessions at least once a week. The EI program increases the level of faculty/student interaction and is in keeping with Tinto's model. Additionally, the Naval Academy has structured the midshipmen's daily routine to ensure the

maximum utilization of the time available while ensuring a high level of academic and social integration. The day is structured around a six period class day, a sports period and an evening study period. On any given weekday a Midshipman will wake up by 6 am, attend a 7 am morning military formation, eat breakfast and be in class by 8 am, attend classes until 1130 am, attend a noon military formation and eat lunch, attend afternoon classes from 1:30 pm to 3:30 pm, and then attend varsity athletic practice or intramural sport practice until evening meal at 6:30 pm. Study period begins at 7:30 pm. Midshipmen use this time to attend EI sessions, prepare for the following day's classes and military obligations, and socialize with their peers. This level of structure helps each midshipmen manage the large academic workload and the high level of institutional commitments.

Although Tinto would support a structured system that promotes academic and social interaction, he would be cautious of the rather large adjustment such a structure imposes on entering freshmen. The formal academic and military requirements compounded with the tight timeline for completion are quite different than those found at civilian institutions. Invariably, midshipmen will experience some level of conflict between their personal goals and intentions and the forced level of institutional commitment. The cumulative effects of this conflict can result in academic failure and an increased propensity to depart the institution.

c. Performance/Conduct Attrition

Service academies place a high level of emphasis on personal and professional conduct and military performance. Approximately 4% of midshipmen depart the Naval Academy for military performance or conduct reasons.

Midshipmen receive a Professional Military Quality Point Rating (MQPR) each semester. The MQPR is calculated similarly to an academic grade point average or quality point rating. The components of the MQPR are physical education grades, athletic performance grades, military performance grades, conduct grades, and professional course grades (Larson, 1995). The military performance grade, which accounts for 65% of the MQPR, has a large impact on a midshipman's Cumulative Quality Point Rating (CQPR) and order of merit (class standing). Midshipmen who are

deemed substandard performers by their chain of command are sent to performance boards. The performance board conducts a thorough review of the midshipman's record and then makes a recommendation to the chain of command. One recommendation the board is authorized to make is dismissal due to substandard performance.

Naval Academy midshipmen receive a conduct grade each semester. The conduct grade is a reflection of the midshipmen's adherence to the MIDREGS (Midshipmen Regulations) manual and accounts for ten percent of their MQPR. The Naval Academy conduct system is a bifurcated system. There are two categories of offense: major offenses and minor offenses. Some examples of minor offenses include: being tardy for class (less than 15 minutes), being unprepared for inspection, usurping upper class privileges, and failing to know plebe rates. Some examples of major offenses include: consumption of alcohol in Bancroft Hall, sexual misconduct, hazing, and violation of the Honor Concept.⁵ Most major offenses are separation-level offenses. This means that the adjudicating authority (the Commandant of Midshipmen) can recommend dismissal to the Superintendent and the Secretary of the Navy if he finds the midshipman guilty of the offense. Minor offenses cannot, by themselves, result in dismissal. Only if a midshipman commits a minor offense while on conduct probation, or commits multiple or repeated minor offenses could a minor offense result in a conduct board and dismissal. Most conduct dismissals are the result of a major conduct offense.

Tinto's model was not written to explain performance and conduct attrition from a service academy, but it still may provide some insight into why midshipmen get into performance and conduct trouble. Performance trouble tends to result when midshipmen find themselves in one of two specific situations. The first is academic trouble. Midshipmen who are unable to integrate and perform academically tend to spend the majority of their time on academics. This means they have less time to attend to their military obligations and professional development. If a midshipman is unable to quickly correct their academic deficiency, or if their problems become protracted, they are likely to enter a degrading academic and performance spiral that usually results in dismissal. The other common cause of performance problems occurs when midshipmen

⁵ The Honor Concept is an ethical precept that states that midshipmen will not lie, cheat, or steal.

find themselves unable to adjust to the highly structured military lifestyle of the Naval Academy. Often times these individuals find their goals are not in alignment with the institution and they cannot, or do not wish to, meet the commitments placed on them by the institution. These individuals if they do not leave voluntarily tend to find themselves before a performance board and are dismissed.

Conduct attrition occurs for similar reasons. Midshipmen who find themselves unable to adjust to the institution's goals and required level of student commitment often find themselves in conduct trouble for violations of MIDREGS. These violations may occur due to their inability to meet all of their commitments or may be a conscious act of frustrated defiance. Repeated conduct trouble or a single major offense results in a conduct adjudication that could lead to dismissal.

C. PERSONALITY MEASUREMENT

The previous sections were meant to provide the reader with a model that explained why students attrite from undergraduate institutions and how that model related to attrition at the Naval Academy. The next step in building the theory behind the attrition model is to develop an understanding of the tools available to help identify individuals who are likely to attrite. The tool currently in use at the Naval Academy is the Career Interest Score (CIS) of the Strong Interest Inventory (SII). The following sections will provide the reader with a description of three personality measures, and how they are or have been, used at the Naval Academy in association with the admissions system or for midshipmen counseling. They are the Strong Interest Inventory (SII), the Myers-Briggs Type Indicator (MBTI) and the Personal History Questionnaire (PHQ).

1. Strong Interest Inventory

a. The Strong Interest Inventory

E.K. Strong Jr. developed the Strong Interest Inventory in 1927 to serve as a career-counseling tool. Strong based his measurement on the theory that individuals are more satisfied and productive when they work in a job that "fits" their personality, and work with people whose interests are similar to their own (Sheppard, 2001).

The SII is comprised of 325 multiple-choice questions, which are categorized into four sets of scales: General Occupation Themes, Basic Interests,

Personal Style, and Occupation. When combined, the four scales create an interest profile for the test taker. This profile helps educate the test taker on his or her likes and dislikes relating to work. The results are meant to assist the test taker in making educational and career choices.

The SII has been validated numerous times since 1927. Donnay and Borgen (1996) performed the most recent validation in 1994. They studied the ability of the SII to predict occupational group membership and found that the Basic Interest Scales were the best and most valid predictors of group membership. According to Conoley and Impara (1994) the SII is the most valid, structurally sound, and comprehensive career placement measure available.

b. Use of the SII at the U.S. Naval Academy

The United States Naval Academy first used the SII in 1967 in an attempt to identify candidates who would succeed in technical majors, but abandoned it shortly thereafter. It appeared again in 1975 when the Navy decided to require 80% of graduating midshipmen to graduate from a technical major⁶ (McNitt, 1982). This requirement served as the catalyst for the development of what is now the Whole Person Multiple. The Naval Personnel Research and Development Center (NPRDC) was asked to develop a multiple which would predict major, military performance, voluntary resignation and four year attrition (Sheppard, 2001). NPRDC included the SII as part of the multiple along with SAT math, Sat verbal, high school class rank, teacher recommendations and Extra Curricular Activity (ECA) scores.

Instead of using all four SII scales in the Whole Person Multiple, NPRDC developed their own. These scales are currently known as the Technical Interest Score (TIS) and the Career Interest Score (CIS). The TIS is meant to predict technical major selection and the CIS is meant to predict voluntary resignation and four year attrition. Both scores have been re-scaled to a range between 1 and 1000.

In an attempt to gain more "relevant" scores, the Naval Academy developed its own scoring key for the SII (Sheppard, 2001). It analyzed raw results of the SII for previous Naval Academy classes and found those questions which, when

⁶ Technical majors are defined as Group I (Engineering) and Group II (Math and Science) majors.

answered properly, were most predictive of technical major selection and career retention.⁷ This strictly mathematical selection process did not take into account the content or meaning of a given question. The statistically identified questions were placed into a grading key. The key assigns a point for correct answers and no points for incorrect answers. The sums of these points are the basis for the TIS and CIS scores.

Applicants take the entire 1984 version of the SII (325 questions) but only their responses to those questions deemed predictive are actually used. The TIS is comprised from responses to 55 of the 325 (Sheppard, 2001) questions and the CIS is comprised from responses to 93 of the 325 questions (Bowman, 2001).

The initial validation studies of the TIS and CIS showed only the TIS to be a valid predictor. It was validated at between .30 and .40 for predicting technical versus humanities major. The validity coefficient for the CIS was only .09. The decision was made to include the CIS in the Whole Person Multiple because it was deemed better than no such predictor at all (McNitt, 1982). Additional studies of the CIS support these initial findings. Bowman found that of the 93 questions used to comprise the CIS, only ten showed any degree of statistical association with the graduation status of midshipmen from the Class of 1999. Eight of the ten were marginally significant,⁸ but four of them had the wrong sign of association. Two of the ten questions were highly significant⁹ and one of them had the incorrect sign of association. In total five of the ten questions had results with the wrong sign of association.

The CIS does not appear to be related to midshipmen retention at the Naval Academy. A careful reading of the SII questionnaire items used to score the CIS suggests that there is no causal relationship between the responses to the selected questions and a midshipman's career intentions. Bowman states that the methodology used to create the CIS was, "purely a data-mining approach to identify relationships" and the questions selected provide, "nothing more than spurious relationships" between the

⁷ This career retention prediction is misleading because no classes admitted under the multiple had completed 20 years of service. Career retention was actually indicative of graduation.

⁸ Marginally significant is determined by a coefficient between .05 and .10.

⁹ Highly significance is determined by a coefficient of .05 or less.

CIS and graduation due to the purely statistical approach used to establish association (Bowman, 2001).

2. Myers-Briggs Type Indicator

The MBTI is a personality questionnaire based on the psychological type theory of Carl Jung. Developed by Katharine Briggs and Isabel Myers, the MBTI groups personalities based on psychological type (Inscape, 1996).

The four continuous scales of the MBTI are derived from four pairs of scoring templates: E (extravert) and I (introvert), S (sensing) and N (intuiting), T (thinking) and F (feeling), and J (judging) and P (perceiving). These combined eight personality indicators, when taken four at a time, form a matrix of sixteen possible personality types. The sixteen types are as follows: ISTJ, ISFJ, INFJ, INTJ, ISTP, ISFP, INFP, INTP, ESTP, ESFP, ENFP, ENTP, ESTJ, ESFJ, ENFJ, AND ENTJ. Within each pair of personality indicators a scale score is determined. Each person's specific type is defined by his or her four scores (Myers, 1998).

Negative values along the four continuous scales represent I, N, F, and P while positive values represent the other four types, E, S, T, and J. It logically follows that people scoring at the low and high end of the scoring templates will more strongly exhibit the tendencies and characteristics that are commensurate with the particular personality indicator (Briggs-Myers, 1998). When describing an individual's personality type one can provide the raw scores on a number scale or choose to only give the specific four-letter combination.

Figure 2 (Page, 1983) below provides the reader with words that form the framework for understanding what these eight personality indicators attempt to convey, and how to differentiate them from one-another.

Figure 2. MBTI Preference Descriptors

<u>Extraversion</u>	<u>Introversion</u>	<u>Thinking</u>	<u>Feeling</u>
Active	Reflective	Head	Heart
Outward	Inward	Objective	Subjective
Sociable	Reserved	Justice	Harmony
People	Privacy	Cool	Caring
Many	Few	Impersonal	Personal
Expressive	Quiet	Criticize	Appreciate

<u>Sensing</u>	<u>Intuiting</u>	<u>Judging</u>	<u>Perceiving</u>
Details	Patterns	Organized	Flexible
Present	Future	Structured	Flow
Practical	Imaginative	Control	Experience
Facts	Innovations	Decisive	Curious
Sequential	Random	Deliberate	Spontaneous
Directions	Hunches	Closure	Openness
Repetition	Variety	Plan	Wait
Enjoyment	Anticipation	Deadlines	Discoveries
Perspiration	Inspiration	Productive	Receptive

Figure 3 (O'Connor, 19993) describes the differences along each of the four continuums of a person's individual preferences.

Figure 3. MBTI Preference Scales

INTROVERT	-----	EXTRAVERT
<u>Interest flows mainly to...</u>		
The inner world of concepts and ideas		The outer world of actions, objects and persons
INTUITING	-----	SENSING
<u>Prefer to perceive...</u>		
The possibilities, relationships, and meanings of experiences		The immediate, real, practical facts of experience and life
FEELING	-----	THINKING
<u>Prefer to make judgments or decisions...</u>		
Subjectively and personally, weighing values of choices and how they matter to others		Objectively, impersonally considering causes of events and where decisions may lead
PERCEPTION	-----	JUDGMENT
<u>Prefer mostly to live...</u>		
In a spontaneous, flexible way, aiming to understand life and adapt to it.		In a decisive, planned and orderly way, aiming to regulate and control events, facts of experience and life

Over fifty years ago the Institute of Personality Assessment and Research (IPAR) began conducting a series of creativity studies. These studies were the first to regularly use the MBTI. Clearly there seems to be some utility in using the MBTI as a way to interpret an individual's personality. In academic studies in other settings, MBTI

research shows that personality can and does impact a person's ability to perform in a military and academic environment (Roush 1989).

"Success in the first year is more probable, certainly for the weaker students, if their personality type is I_TJ" (Rosati, 1997, p. 1), that is, if they are introverted, thinking, and judging types. Moreover, success in an engineering curriculum is also associated with I_TJ types, with INTJ being the most successful. All Naval Academy Baccalaureate degrees are Bachelor of Science degrees, and all the courses of study at the Naval Academy are steeped in a broad base of mathematics and science. These facts tend to make the academic challenge for all Naval Academy students in large part an engineering challenge.

Interestingly, within the service academy population there are a disproportionate percentage of thinking types, with a split of about 75% thinking types and 25% feeling types. In contrast, the average adult population (over 18yrs old) is 53% thinking types and 47% feeling types (Hammer & Mitchell, 1996).

When specifically looking at US Naval Academy voluntary attrition, Roush found the following. Midshipmen with a feeling preference resigned at more than twice the rate of Midshipmen with a thinking preference. Additionally, intuitive types departed at a much greater rate than sensing types (Roush, 1989). The adult male population is comprised of 69% thinking types and 64% sensing types; whereas the adult female population is comprised of 39% thinking types and 71% sensing types (Hammer & Mitchell, 1996). In light of the greater tendency for Academy females to be of the feeling preference, it would follow that women would have a higher attrition rate than the men. The following tables provide additional information regarding the differences by MBTI type for males and females

Table 1. Female MBTI Distributions for the Classes of 1995-2000

E, S, T, & J Distributions	I, N, F, & P Distributions	Mean Scores
64% Extravert	36% Introvert	6.6 Extravert
50% Sensing	50% Intuiting	1.7 Sensing
66% Thinking	34% Feeling	11.3 Thinking
65% Judging	35% Perceiving	9.3 Judging

Table 2. Male MBTI Distributions for the Classes of 1995-2000

E, S, T, & J Distributions	I, N, F, & P Distributions	Mean Scores
52.5% Extravert	47.5% Introvert	0.9 Extravert
53% Sensing	47% Intuiting	3.1 Sensing
78% Thinking	22% Feeling	20.2 Thinking
60% Judging	40% Perceiving	5.7 Judging

Tables 1 and 2 show mean MBTI scores by gender for each of the eight personality types. The range of scores for each type was 0 to plus or minus 60. E, S, T, & J scores were positive, while their opposites on the scoring continuum (see figure 3), I, N, F, & P had negative values. Women and men at the Naval Academy tend to be E, S, T, and J types. However, there is a statistically significant difference between the two sexes and their MBTI classifications.

Table 3 shows the significant difference in means for male and female MBTI types at the Naval Academy. This difference is significant for all of the personality continuums except for the sensing-intuiting continuum.

Table 3. Independent Sample T-Test of Gender and MBTI Type

	t	2-Tailed Sig	Mean Differences
ESCORE	6.15	.000	+5.70
SSCORE	-1.35	.170	-1.37
TSCORE	-10.07	.000	-8.93
JSCORE	3.47	.001	+3.53

Roush concluded that voluntary attrition, early on in the four-year process, was caused by one of two things. The Midshipman was either unable to meet the academic or military rigors of life at the Academy (Roush, 1989). This is in keeping with Tinto's theory that states that a student's propensity to leave is a reflection of his or her ability to integrate Academically and Socially. In this case, social integration is synonymous with integration into the military lifestyle. Roush also found that the thinking preference produced success in both the engineering based academics as well as the concrete and logical underpinnings of the military environment. Introverts tended to perform better in the classroom, which tended to offset the negative effects of being in an uncomfortable military environment that requires frequent and rich communication (Roush, 1989).

2. Personal History Questionnaire

As noted above, graduation, voluntary attrition, and academic attrition have previously been found to correlate with personality as described by the MBTI. Beyond the basic framework of personality that is described by the MBTI a person's character, interest and upbringing provide additional insights and help to form a more complete psychological profile. This study will examine the utility of adding the information available within the PHQ to a person's psychological make-up, and how all this information can be used to predict the attrition of future Midshipmen.

The Personal History Questionnaire is a survey consisting of eighty-five questions pertaining to an individual's self-image, family, interests, and experiences, and it attempts to provide additional psychological insight. Prepared by Naval Personnel Research, Studies & Technology Center (NPRST) in the mid-nineteen eighties, the PHQ was the Navy's answer to the SII. According to John Bearen, an employee of NPRST who worked on the PHQ program, the PHQ was developed as a backup to the SII. It was developed in case Stanford Press manipulated the SII pricing arrangement with USNA. The PHQ was administered to the entering USNA classes of 1988 thru 2000 (personal Communication, March, 2002). Though no longer administered by USNA to the incoming classes, the results of this survey are still on file, and are used in this study to gather additional information on possible predictors of attrition.

The PHQ originated from three different sources. Its authors borrowed from items existing in the public domain, modifications of items found in other commercially available questionnaires, and several items authored by NPRST employees. Though designed to replace the SII, there exists no documentation pertaining to its effectiveness in this capacity.

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III. RESEARCH METHODOLOGY

A. THEORETICAL MODEL

This study's general purpose is two-fold. The first is to provide the Naval Academy Admissions Board with additional empirical data to assist them in selecting the highest quality applicants from the applicant pool. It's more specific objective is to determine the significance of the CIS, MBTI and the PHQ in predicting attrition. In order to accomplish this objective, the study utilizes four variations of a basic mathematical model.

All of the model variations use and build upon the basic structure of the Whole Person Multiple (WPM). The base model uses the same performance measures used by the Office of Admissions in the WPM¹⁰ while controlling for demographic differences. The performance measures that constitute the base model account for 75% of the WPM score. The remaining 25% is comprised of scores for the two scales of the SII (12% TIS & 3% CIS) and ECA scores (10%). Although ECA information is one of the performance measures used in the Multiple, it was not used in the base model because 1614 records were missing ECA data. Additionally, TIS was not included in the base model. The reasons for not including the TIS are twofold. First, it is not a performance measurement variable. It was created to identify candidates who had a high propensity to select a technical major. Second, because the methodology of the thesis was to show the inability of the SII, specifically the CIS, to predict attrition, the authors chose to eliminate all scales of the SII from the base model. The variations of the model add MBTI and PHQ data, respectively, to the basic model to determine whether or not they improve predictions of attrition.

Existing research and research conducted in conjunction with this study indicate that there is no explicit causal relationship between responses to the Career Interest Score of the Strong Interest Inventory and a propensity to persist. Moreover, the methodology used to compile the CIS is neither scientifically nor statistically sound once the desired outcome (persistence) is taken into account. For these reasons, the decision was made

¹⁰ SAT math, SAT verbal, combined rank of school officials, and high school official rank.

not to include the SII in the basic model and to investigate the ability of the MBTI and/or the PHQ to replace it in the Whole Person Multiple.¹¹ This conclusion served as the impetus for the three variations of the basic model. The first variation consists of the base model with the addition of MBTI data. The second variation is the base model with just PHQ data added. The third and final variation consists of the base model plus MBTI and PHQ data. Our data analysis strategy, then, is to see whether the addition of the MBTI and PHQ data individually or simultaneously significantly increases the ability to predict attrition at the Naval Academy.

B. THE DATA SET

The basic information is drawn from the data warehouse maintained by the U.S. Naval Academy's Department of Institutional Research. Institutional Research compiles data from the Admissions Information System (AIS) and the Midshipman Information Data System (MIDS) to provide a complete file consisting of high school performance, demographic data, personality data, and midshipman performance data.

A review of the existing data set revealed approximately 1600 records that were missing one or more of the variables used in the study. Exhaustive descriptive analysis was used to further investigate these records. A large portion of the records with missing data came from the classes of 1995 and 1999. These records proved to be representative of the entire data set in every other way. Perhaps more important, the remaining records from the classes of 1995 and 1999 were closely comparable with the other cohorts in the data set and the data set as a whole. Although smaller than the other cohorts, the remaining data from both classes are similar in their distribution of performance, control, and personality variables. Their propensity for graduation, and the three forms of attrition are on par with the other classes in the data set. Based on this information, the decision was made to omit all 1600 records. Therefore, the final data set contains files on 5691 midshipmen from the graduating classes of 1995-2000.

C. METHODOLOGY

Developing the study's statistical model is a four-step process. The first step involves a detailed examination of the process and variables used by the Office of

¹¹ The regression results that support this conclusion are available in CH 4.

Admissions when selecting candidates from the applicant pool. The performance variables (SAT math, SAT verbal, combined recommendation of school officials and high school official rank), which comprise the main components of the Whole Person Multiple, form the majority of the base model. The second step involves the addition of control variables (Gender and Race) in order to account for possible demographic differences. The combination of performance variables and control variables constitutes the base model. The third step involves an in-depth study and analysis of MBTI and PHQ personality data. Adding these sets of variables one at a time and collectively to the base model creates an additional three versions of the model. The fourth and final step focuses on a study of Naval Academy exit data with the intent to gain a more complete understanding of the reasons for attrition.

The exit data showed that Naval Academy attrition data could be categorized into three main types. They are, in order of magnitude, voluntary attrition, academic attrition, and performance/conduct attrition. These three attrition variables and overall attrition act as the model's four dependent measures.

The first step in analyzing the data involves a descriptive analysis of the 1995-2000 data set. This analysis provides for a better understanding of the basic statistical characteristics surrounding the model variables. After descriptive analysis is complete, the data is segregated into two sub-sets. The primary subset is comprised of data from the classes of 1995-1999. The second subset of data only includes data for the class of 2000.¹² This data is set aside to serve as an out of sample data set. It is used later in the analysis to measure the ability of the model to predict the various forms of attrition for a single incoming class.

At this point it is necessary to statistically assess the ability of the CIS to predict attrition. This is accomplished by entering the base model augmented by the CIS into a series of binary logistic regressions with each of the four dependent variables (overall, voluntary, academic, and performance/conduct attrition). The results of these regressions are necessary to show the insignificance of the CIS and to show its inability to act as a predictor of attrition. These results can then be used for comparison with the regression

¹² Although the class of 2000 was segregated during regression analysis, all initial statistical analysis was conducted using a data set containing the classes of 1995-2000. This data set contains 5691 records.

results obtained by the four-version model (base model, MBTI augmented model, PHQ augmented model, and fully augmented model).

The next step in the analysis uses the four-version model to conduct binary logistic regressions of the 1995-1999 data set. Each of the four versions of the model is entered into a regression with each of the four dependent measures: overall attrition, voluntary attrition, academic attrition, and performance/conduct attrition. This produces a set of sixteen regression outputs.

The final step of analysis involves using the results of the 1995-1999 regressions to conduct an out-of-sample prediction of attrition for the class of 2000, and to compare these predictions with the actual attrition experienced by the class of 2000. This out-of-sample prediction process is performed to strengthen the validity of the regression results as well as to legitimize the use of such information in future admissions board deliberations.

D. CREATING THE PHQ INSTRUMENT

The majority of the responses to the eighty-five questions from the PHQ are arranged on a Likert scale. Thirty-four questions from the eighty-five available are grouped into the following categories: Money, Hard Work, Confidence, and Military Lifestyle. These categories and the specific questions utilized will be described in detail later in this chapter. Miscellaneous PHQ questions that did not fall into any of these four categories, and questions to which there is little or no variance of response were not used in the study. Six, eleven, nine, and eight questions are used in each category, respectively. Scaled responses for questions were converted to dichotomous responses. A value of one was assigned to all positive, or desirable responses to a given question. Negative or non-desirable responses to a question were given a value of zero. The decision to transform the responses to dichotomous values, instead of assigning numeric values to each possible response, came as a result of the initial analysis of each PHQ question. Initial analysis indicates that scaled responses to most questions do not correspond with similarly scaled effects on attrition. In fact, most questions revealed a threshold for which responses above or below the threshold had a more direct correspondence to attrition than the scaled responses individually. For example, if a

question had response values of one thru five, a value of five was not slightly better than a value of four which was slightly better than a value of three. Instead, for most questions, values above a threshold of responses proved to correlate to the dependent variables while values below the threshold did not. For example, values of three and above may have had a positive correlation to the dependent variables and were assigned a value of one while values below three had a negative correlation and were assigned a value of zero. Finally, these dichotomous responses were summed within each category to compute a composite score for that category.

E. VARIABLE DEFINITIONS

The purpose of this portion of the study is to provide the reader with a better understanding of the variables in the data set. The following sections briefly describe each of the model's dependent and independent variables. Each section includes a chart that summarizes the names, definitions, and ranges for each variable.

1. Dependent Variables

Midshipmen who leave the Naval Academy prior to graduation are assigned one of twenty-eight different attrition codes. Institutional Research records and stores this data as a variable called attrcode (attrition code). An analysis of the attrition data produced 28 different attrition codes. These codes could be categorized into four general areas: voluntary attrition, academic attrition, performance/conduct attrition, and physical disqualification/death. Those midshipmen who were physically disqualified or died prior to graduation were removed from the data set.¹³ This study focuses on overall attrition and the three main sub-categories of attrition. All four dependent variables are dichotomous. In this case all four variables could have values of one or zero. A value of one signifies an individual who leaves before graduation and a value of zero signifies someone who graduates. For example, a midshipman with a one listed for the academic attrition variable attrited for academic reasons. Table 4 below provides a brief description of the dependent variables.

¹³ 32 midshipmen were removed from the data set due to death or physical disqualification.

Table 4. Dependent Variable Definitions

Abbreviation	Variable Name	Definition	Values
ATTRITE	Overall Attrition	Midshipmen who attrite for any reason	0 = Graduate 1 = Attrite
VOLUN	Voluntary Attrition	Midshipmen who attrite voluntarily	0 = Graduate 1 = Voluntary Attrite
ACADEM	Academic Attrition	Attrition due to inadequate academic performance	0 = Graduate 1 = Academic Attrite
PERFCON	Performance/Conduct Attrition	Midshipman who attrite for inadequate performance or conduct violations	0 = Graduate 1 = Perf/Con Attrite

Voluntary Attrition (VOLUN): The voluntary attrition variable represents those midshipmen who leave voluntarily (1), versus those who graduate (0). Those who attrite for academic or performance/conduct reasons are not included in this variable. In year groups 1995-2000, 14.9 percent of the midshipmen left the Naval Academy voluntarily. If the basic, or underlying cause of attrition is masked or unknown, then the appropriate specification is over-all, or total attrition.

Academic Attrition (ACADEM): The academic attrition variable represents only those midshipmen who resigned or were discharged due to academic difficulty (1) versus those who graduated (0). It does not include those midshipmen who left for voluntary or performance/conduct reasons. The academic attrition rate for the classes 1995-2000 is 3.6 percent.

Performance/Conduct Attrition (PERFCON): The performance/conduct attrition variable represents those midshipmen who are dismissed, discharged, or allowed to submit a qualified resignation due to performance/conduct problems (1) versus those who graduated (0). It does not include midshipmen who left for voluntary or academic reasons. The performance/conduct attrition rate for the classes of 1995-2000 is 2.8 percent.

Overall Attrition (ATTR): The attrition variable represents those midshipmen who attrite for any reason (1) versus those midshipmen who graduate (0). The attrition rate for the classes of 1995-2000 is 21.3 percent.

2. Independent Variables

The independent variables can be categorized into three groups; high school performance variables, demographic control variables, and personality variables. The following sections define and describe each category of variables used in the model.

a. Performance Variables

The performance variables are derived from the Whole Person Multiple. They are: SAT math, SAT verbal, combined recommendations of school officials, and high school official rank. These variables account for 75% of the WPM. Table 5 below provides a brief description of the performance variables used in the model.

Table 5. Performance Variable Definitions

Abbreviation	Variable Name	Definition	Values
SATMHI	SAT Math	Highest SAT Math score	200-800 pts
SATVHI	SAT Verbal	Highest SAT Verbal score	200-800 pts
RSO_COMB	Rank of School Official	Combined rankings from high school English and Math/Science teachers	400-999 pts
HSOFFRNK	High School Rank	Standardized H.S. graduating class rank. Takes into account the size and difficulty of the H.S.	300-800 pts

SAT Math (SATMHI): The SAT math variable represents the applicant's highest score achieved on the math portion of the SAT. This score can range from a low of 200 to a perfect score of 800. The mean math SAT score for these classes is 659 with a standard deviation of 59 points (refer to Table 6). SAT Math would be one way to measure a student's skills and abilities or prior schooling. Therefore, based on Tinto's model of institutional departure, the higher the SAT score, the more likely that student will succeed academically and persist until graduation. For this reason, SAT math is expected to have a negative sign in the regression outcome.¹⁴ For a distribution of scores for the classes of 1995-2000 refer to Figure 4.

SAT Verbal (SATVHI): The SAT verbal variable represents the applicant's highest score achieved on the verbal portion of the SAT. This score can range from a low of 200 to a perfect score of 800. The mean verbal SAT score for these classes is 634 with a standard deviation of 66 points (refer to Table 6). Based on Tinto's model,

¹⁴ A negative sign in the regression outcome means the person is less likely to attrite.

the SAT verbal score's expected regression output sign is negative, or, the higher the score the less likely the student is to attrite. For a distribution of scores for the classes of 1995-2000 refer to Figure 4.

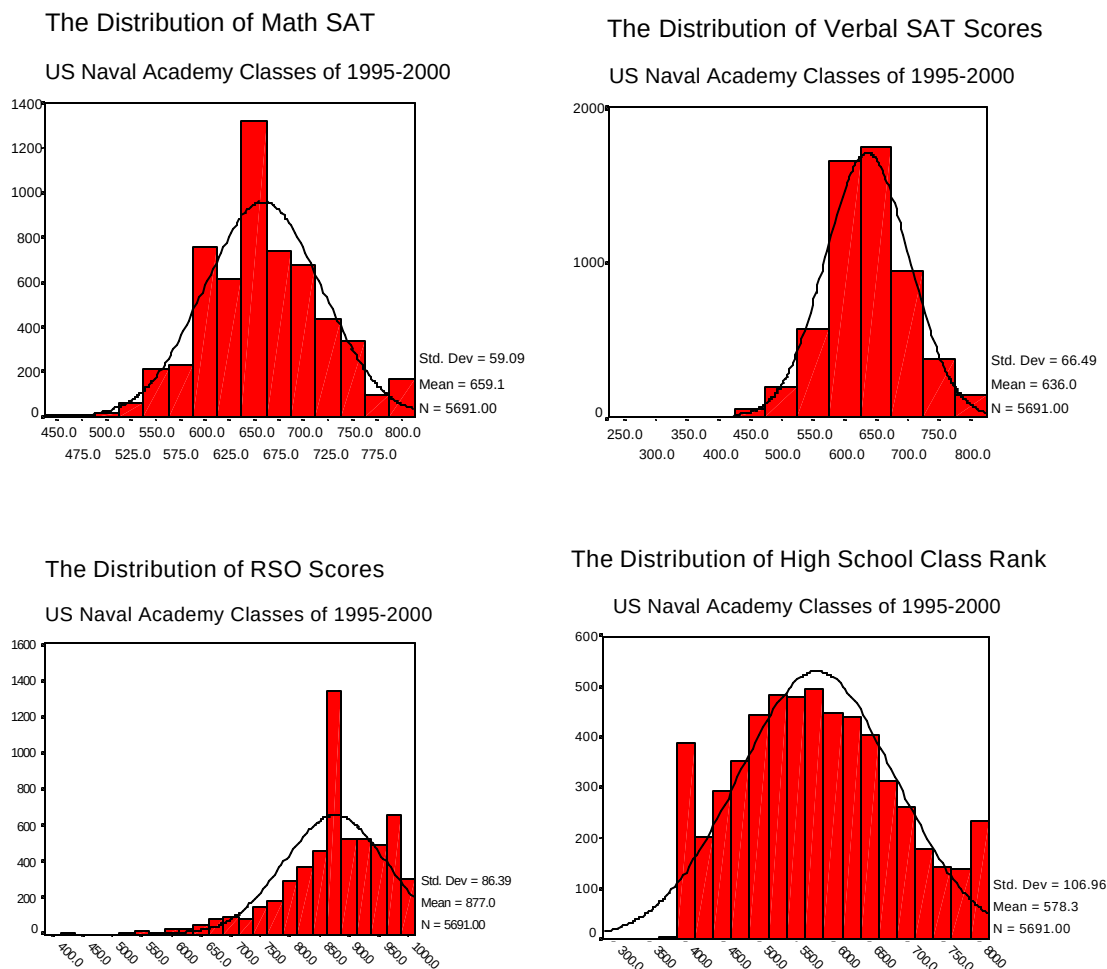
Combined Recommendations of School Officials (RSO_COMB): RSO combined is a numeric score on a standardized scale of 400-999. This value is a representation of the applicant's ability and is derived from confidential questionnaires provided to the applicant's high school English and Math/Science teachers. Scores for the classes of 1995-2000 range from 409 to 999 points. The mean score is 877 with a standard deviation of 86 points (refer to Table 6). RSO seems to be a good indicator of a student's skills and abilities. Based on Tinto's model, the higher the value of the RSO score, the greater the student's skills and abilities, therefore, the less likely he or she will attrite. Thus the RSO variable is assigned a negative expected sign. See Figure 4 for a distribution of scores for the classes of 1995-2000.

High School Official Rank (HS_OFFIC): High school official rank is a standardized numeric score that represents an applicant's high school class rank. The actual rank is converted to a value on a standardized scale of 300 to 800. The standardization process accounts for the differences in the sizes and competitiveness of the high schools from which applicants matriculate. The mean score is 578 points with a standard deviation of 107 (refer to Table 6). High School Official rank is perhaps the best indicator of a student's ability, and is assigned a negative expected sign. See Figure 4 for a distribution of scores for the classes of 1995-2000.

Table 6. Performance Data Descriptive Statistics

	Expected Sign	Minimum	Maximum	Mean	Std. Deviation
SATM_HI	-	450	800	659.09	59.09
SATV_HI	-	230	800	635.96	66.49
RSO_COMB	-	409	999	877.00	86.39
HS_OFFIC	-	300	800	578.35	106.96

Figure 4. Graphic Representation of Performance Variable Distributions



b. Control Variables

Gender and ethnicity serve as the model's control variables. Ethnicity is broken down into five dichotomous variables, each representing one of the five main ethnic groups at the Naval Academy. Table 7 below provides a brief description of the model's control variables. Table 8 provides the expected regression output sign of each control variable as well as the percentage of the data set each variable represents.

Table 7. Control Variable Definitions

Abbreviation	Variable Name	Definition	Values
MALE	Gender	Gender	0 = Female, 1 = Male
HISPAN	Hispanic American	Hispanic or Puerto Rican Ethnicity	0 = Other 1 = Hispanic
AFRICAN	African American	African Ethnicity	0 = Other 1 = Africa American
ASIAN	Asian American	Asian or Filipino Ethnicity	0 = Other 1 = Asian/Filipino
NATIVE	Native American	Native American and Native Hawaiian	0 = Other 1 = Native American
CAUCAS	Caucasian	Caucasian	0 = Other 1 = Caucasian

Table 8. Gender and Ethnicity Variables: Expected Signs and % of Population

Variable	Expected Sign	Frequency	Valid Percent
Female	+	4845	14.9
Male	-	846	85.1
Caucasian	-	4665	82.0
Hispanic	+	379	6.7
African American	+	349	6.1
Asian American	-	240	4.2
Native American	+	58	1.0

Table 8 above lists the expected signs for each of the demographic control variables. Positive signs indicate an expectation of an increased correlation between the variable and attrition; negative signs indicate an expectation of a decreased correlation between the variable and attrition. For example, Females, Hispanics, African Americans and Native American's all have positive expected signs. This means that members of these particular variable sets are expected to have higher correlation with attrition, or, more simply stated, will be more likely to attrite.

Gender and ethnicity have been closely examined for any underlying differences between groups. Descriptive analysis of the performance variables indicates that although women have higher RSO scores and high school official rank scores, they are still more likely than males to attrite from the Naval Academy. Therefore females are assigned a positive expected sign.

Similarly when compared with the school's Caucasian majority the remaining ethnicities, with the exception of Asian-Americans, score lower on the performance

variables. Asian Americans score higher than the mean on the SAT Math, school official marks, and graduate higher in their high school class. Therefore, only Caucasians and Asian Americans are assigned negative expected signs, which indicate a lower propensity for attrition.

c. Personality Variables

The personality variables used in the model are comprised of four MBTI and four PHQ variables. As stated earlier, these variables are used in place of the CIS in an effort to better predict attrition from the Naval Academy.

(1) *MBTI Variables.* Each of the four MBTI variables is measured on one of four numeric scales centered on zero. The variable score represents a person's location on the continuum between opposing personality preferences. The four variables actually represent eight possible personality preferences. For example, the ESCORE variable represents extravert and introvert personality preferences. The E-I continuum is a numeric scale centered on zero where negative values represent a person's introvert score and positive values represent a person's extravert score. The greater the absolute value of a score, (the further the score is from zero) the more strongly E or I that midshipman is. Table 9 provides a brief description of the MBTI variables used in the model. Table 10 provides percentages for each personality preference within the data set.

Table 9. MBTI Variable Definitions

Abbreviation	Variable Name	Definition	Values
ESCORE	MBTI Position One numeric score	Magnitude of Tendency on E-I continuum	- Values = Introvert + Values = Extravert
SSCORE	MBTI Position Two numeric score	Magnitude of Tendency on S-N continuum	- Values = Intuition + Values = Sensing
TSCORE	MBTI Position Three numeric score	Magnitude of Tendency on T-F continuum	- Values = Feeling + Values = Thinking
JSCORE	MBTI Position Four numeric score	Magnitude of Tendency on J-P continuum	- Values = Perceiving + Values = Judging

Table 10. MBTI Preference by Percentage

MBTI Position 1

	Frequency	Percent
Introvert	2604	45.8
Extravert	3087	54.2

MBTI Position 2

	Frequency	Percent
Intuitive	2699	47.4
Sensing	2992	52.6

MBTI Position 3

	Frequency	Percent
Feeling	1342	23.6
Thinking	4349	76.4

MBTI Position 4

	Frequency	Percent
Perceiving	2247	39.5
Judging	3444	60.5

Extravert-Introvert Score (ESCORE): The E Score variable represents a midshipman's numeric score on the introvert-extravert spectrum. Introverts are represented by negative values and extraverts are represented by positive values. For the classes of 1995-2000, the E-I scores range from -57 (Introverted) to +51 (Extraverted). Overall, the Brigade of Midshipmen tends to be slightly extraverted. According to Table 11, the mean score on the introvert-extravert spectrum was a 1.8. Initial descriptive analysis shows that overall, Extraverts attrite at a lower rate than Introverts. Roush's study supports these findings for overall and voluntary attrition; however, he found that Extraverts were actually more likely to attrite academically. This difference academically is most attributable to the way introverts and extraverts function in their environments. Extraverts are more apt to seek out others for social interaction. This desire to interact takes away from the extravert's study time. Introverts, on the other hand, are content to sit alone at a desk and study. Because they do not constantly feel the need to interact with others, they are able to concentrate and focus on their studies for longer periods of time than the extravert. Extraverts who seek out too much social interaction can end up in academic trouble even if they have the ability to succeed. Overall, however, the extravert is a better fit in a military setting. In this social situation, the extraverts desire to interact becomes a benefit. It is the introvert who has trouble in the military setting, especially if they have a high level of anxiety about performing in front of others. Based on these findings, ESCORE is assigned a negative expected sign. That is, the more strongly E a person is the less likely they will attrite.

Sensing-Intuition Score (SSCORE): The S Score variable represents a midshipman's numeric score on a sensing-intuition spectrum. Intuitive personalities are represented by negative values and sensing personalities are represented by positive values. The S-N scores range from -51 (intuiting) to +67 (sensing). The

mean sensing-intuiting score for the Brigade of Midshipmen is 2.9. Again, based on this preliminary data, Sensing personality types are assigned a negative expected sign.

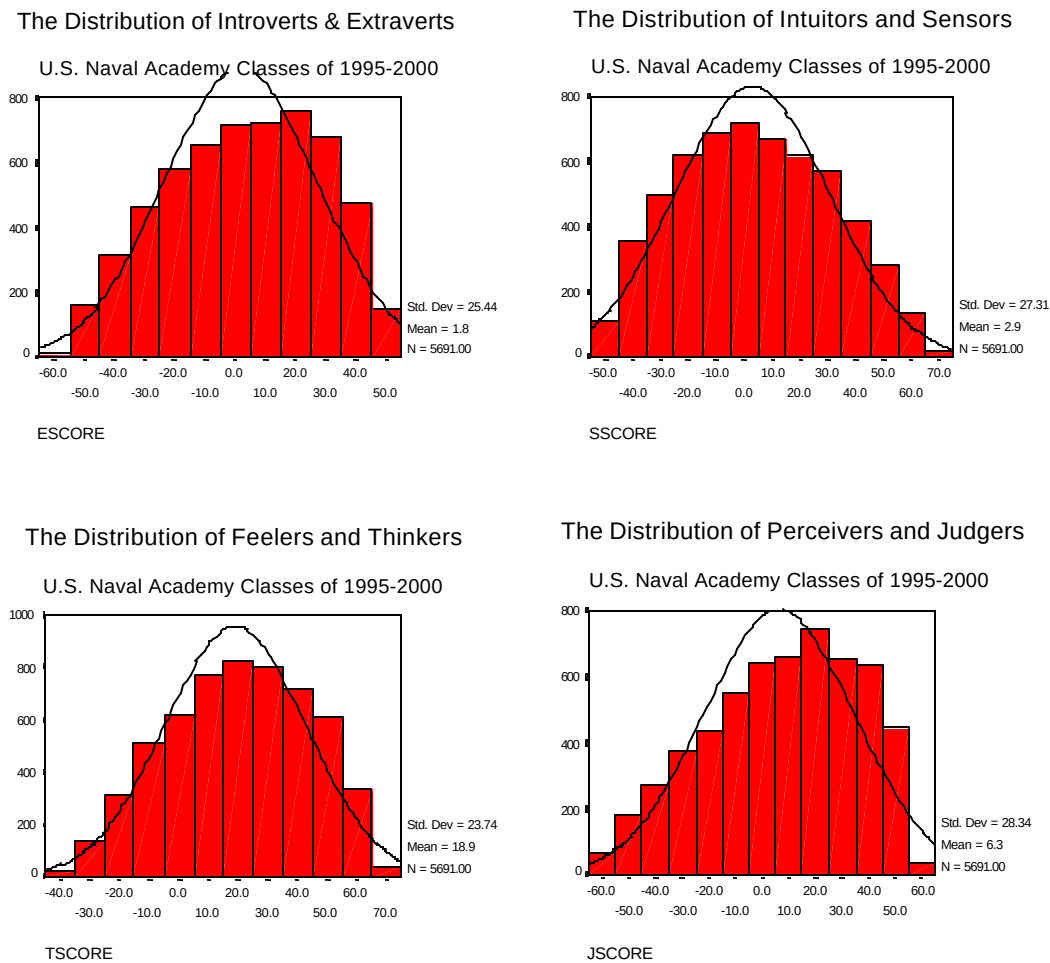
Thinking-Feeling Score (TSCORE): The T Score variable represents a midshipman's numeric score on a thinking-feeling spectrum. Feeling personalities are represented by negative values and Thinking personalities are represented by positive values. The T-F scores range from -41 (feeling) to +65 (thinking). The mean Thinking-Feeling score for the Brigade of Midshipmen is 18.9. This high mean score suggests that most midshipmen tend to be thinkers. Roush found success at the Naval Academy, especially academic success, is closely tied to the Thinking personality type. He believes this is due to the heavily technical engineering based curriculum required of all midshipmen at the Naval Academy. Therefore, TSCORE is also assigned a negative expected sign.

Judging-Perceiving Score (JSCORE): The J Score variable represents a midshipman's numeric score on a judging-perceiving spectrum. Perceiving personalities are represented by negative values and judges are represented by positive values. The Judging-Perceiving continuum presented the greatest range of scores for the classes of 1995-2000. Scores ranged from a -61 (Perceiving) to 55 (Judging). The mean score was 6.3 and the standard deviation was the largest of the four groups at 28. The distribution of scores in Figure 5 is shifted to the right of center and suggests that most midshipmen tend to be judging types. Roush found that Judging personality types were more successful at the Naval Academy and as a personality type were less likely to attrite than Perceivers. It is Roush's belief that Judging types are better able to acclimate to and function in the Naval Academy's demanding military and academic environment. Therefore, the JSCORE variable is assigned a negative expected sign.

Table 11. MBTI Descriptive Statistics

	Expected Sign	Minimum	Maximum	Mean	Std. Deviation
ESCORE	-	-57	51	1.8	25.4
SSCORE	-	-51	67	2.9	27.3
TSCORE	-	-41	65	18.9	23.7
JSCORE	-	-61	55	6.3	28.3

Figure 5. Graphic Representation of MBTI Preference Distributions



(2) *PHQ Variables.* This section provides a description of the PHQ variables and illustrates how each variable was developed. Following each of the definitions provided for the four PHQ variables, the questions that were used to create that variable are listed. The black line shows the separation of responses and the zeros and ones to the left of the responses illustrate the value assigned to those responses. A copy of the entire PHQ survey is included in Appendix A. Table 12 below, provides a brief description of the PHQ variables used in the model.

Table 12. PHQ Variable Definitions

Abbreviation	Variable Name	Definition	Values
MONEY_GR	Money	Describes the extent to which a candidate supported him or herself financially.	0 - 6
HWOR_K_GR	Hard Work	Describes a candidate's work ethic	0 - 11
CONF_GR	Confidence	Describes a candidate's confidence and self-image	0 - 9
MILIF_GR	Military Lifestyle	Describes a candidate's comfort level with a military environment	0 - 8

Money Score (MONEY_GR): The Money variable describes a candidate's employment history. More specifically it identifies to what extent a person monetarily supported their own lifestyle. The higher the score, the more that candidate worked at a paying job. However, having a paying job before the age of sixteen was seen as a disadvantageous history. The responses not only indicate the age and the time commitment involved in these paying jobs, but also, the timing of the jobs with respect to the school year. The money variable provides limited insight into a candidate's family background, which Tinto uses in his model to describe a candidate's pre-entry attributes. Additionally, it provides commentary on a candidate's level of self-responsibility and time management skills. Based on this reasoning, the money score is given a negative expected sign.

The numeric score for the money variable is derived from the summation of the dichotomous recoding of the following six questions from the PHQ survey.

Figure 6. Questions Used in the Money Variable

Q1. When I first earned money on a regular basis (other than from members of my family), my age was:

- a. 12 or younger
- b. 13-14
- c. 15

0

1

- d. 16 or older
- e. I haven't had a paid regular job

Q2. How many hours a week have you usually worked on paying jobs since the beginning of the 11th grade? (Do not include summer jobs)

- a. None
- b. 1 to 10 hours
- c. 11 to 15 hours

0

1

- d. 16 to 20 hours
- e. More than 20 hours

Q7. During the last couple of years, the part of my own support that I personally earned was approximately,

- 0** a. Less than 10%
b. 10% to 30%
-
- 1** c. More than 30% but less than 60%
d. 60% to 90%
e. More than 90%

Q13. Since I started high school, my money for recreation (or "extras") usually came from:

- 0** a. Allowance and gifts from family
b. Mostly allowance and gifts, some my own earnings
-
- 1** c. Mostly my own earnings, some from the family
d. All from my own earnings

Q32. This question was preceded by the following two sentences.

"Listed below are some of the traditional advantages of a military career and a Naval Academy education. Using the following scale, indicate how important each item was in your decision to consider a military career."

Q32. Financial and tuition benefits

- 0** a. Extremely important
-
- 1** b. Very important
c. Important
d. Rather unimportant
e. Very unimportant

Q41. This question was preceded by the following sentence.

"Using the following scale, indicate how important it is to you personally, to pursue each of the goals listed below."

Q41. Financial success

- 0** a. Extremely important
-
- 1** b. Very important
c. Somewhat important
d. Somewhat unimportant
e. Very unimportant

Hard Work Score (HWORK_GR): The Hard Work variable describes a candidate's responses to questions pertaining to their work ethic. More specifically it identifies self-motivation, satisfaction in mission accomplishment, and persistence. The higher the score, the more that candidate indicated a tendency to work hard when accomplishing a task. Therefore, the expected sign of the hard work variable is negative.

The numeric score for this variable is derived from the summation of the dichotomous recoding of the following eleven questions from the PHQ survey.

Figure 7. Questions Used in the Hard Work Variable

Q3. I usually do:

- 1** a. Much more than I resolve to do
b. A bit more than I resolve to do
-
- 0** c. Never less than what I have resolved to do
d. A little less than I resolve to do
e. Much less than I resolve to do

Q5. When doing something difficult:

- 0** a. I give up very quickly
b. I give up rather quickly
c. I give up somewhat quickly
d. I don't give up too soon
-
- 1** e. I usually see it through

Q12. How often do you accomplish what you must do without having to be pushed to do it (by others)?

- 1** a. Always
b. Very often
-
- 0** c. Often
d. Sometimes but not often
e. Rarely

Q14. If I wake up in the morning feeling a little "out of sorts" but don't feel really ill, I:

- 0** a. Don't go to school or work because it's possible that I might be coming down with something serious.
b. Go to school or work but take medicine "just in case" or let everyone know just how bad I feel
c. Go to school or work without any unnecessary complaining but consider going home if I get noticeably worse
-
- 1** d. Go to school or work without hesitation because I consider that my responsibilities come first

Q22. If I have not attained my goal and have not done a task well then:

- 1** a. I continue to do my best to attain the goal
b. I exert myself once again to attain the goal
c. I find it difficult not to lose heart
-
- 0** d. I'm inclined to give up
e. I usually give up

Q38. This question was preceded by the following sentence.

"Using the following scale, indicate how important it is to you personally, to pursue each of the goals listed below."

Q38. A sense of accomplishment

- 1** a. Extremely important
-
- 0** b. Very important
c. Somewhat important
d. Somewhat unimportant
e. Very unimportant

Q53. How well do you do most things you have decided to do?¹⁵

- 1** a. I almost always succeed in the things I attempt and do them better than most people do
b. I often find that I have bitten off more than I can chew and have to give up
-
- 0** c. I usually get the things done that I attempt, but I seldom do them as well as I want to
d. I find that I do most things as well as other people do
e. I seldom get the things done that I attempt, but I usually do them better than other people

Q54. Which of the following is most typical of your study habits?

- 1** a. I work quite regularly
b. I usually get to work when deadlines get close
-
- 0** c. I usually have to be in the mood
d. I work quite irregularly

Q59. How hard do you usually work at getting good grades in high school?

- 1** a. I work very hard.
-
- 0** b. I could work a little harder.
c. I could work a lot harder.
d. I don't have to work hard, I get good grades easily

Q65. & Q72. These questions were preceded by the following sentence.

"Using the following scale, indicate the extent to which each of the statements below applies to you."

Q65. I meet my obligations on time.

- 1** a. Very characteristic of me
-
- 0** b. Somewhat characteristic of me
c. Slightly characteristic of me
d. Somewhat uncharacteristic of me
e. Very uncharacteristic of me

72. I complete projects on time by making steady progress

- 1** a. Very characteristic of me
b. Somewhat characteristic of me
-
- 0** c. Slightly characteristic of me
d. Somewhat uncharacteristic of me
e. Very uncharacteristic of me

Confidence Score (CONF_GR): The Confidence variable describes a candidate's confidence and self-image. More specifically it identifies a candidate's outlook academically, militarily, professionally, and socially. The higher the score, the more that candidate indicates a positive view of an uncertain future and the less likely he or she would attrite (negative expected sign)

¹⁵ Although response B to question 53 has a negative connotation, the data shows that those who answered B actually did better at the Naval Academy. The authors believe this response depicts an individual who is aggressive, yet possesses the maturity level required to provide honest self-evaluations. This level of maturity translates into good decision-making and results in success at the Naval Academy.

The numeric score for this variable is derived from the summation of the dichotomous recoding of the following nine questions from the PHQ survey.

Figure 8. Questions Used in the Confidence Variable

Q15., Q17., Q18., & Q19 These questions were preceded by the following sentence.

"Listed below are some activities and concerns of first year Naval Academy students. Using the following scale, indicate how you estimate each item will apply to you during your first year at the Academy."

Q15. Earn academic honors

- 1** a. Highly probable
b. Somewhat probable

-
- 0** c. Somewhat improbable
d. Highly improbable

Q17. Need tutoring in one course

- 0** a. Highly probable
b. Somewhat probable

-
- 1** c. Somewhat improbable
d. Highly improbable

Q18. Earn military honors

- 1** a. Highly probable
b. Somewhat probable

-
- 0** c. Somewhat improbable
d. Highly improbable

Q19. Have difficulties with studies or concentration

- 0** a. Highly probable

-
- 1** b. Somewhat probable
c. Somewhat improbable
d. Highly improbable

Q27. By the end of my first semester at the Academy I expect my grades will be:

- 0** a. Good in some courses, low in others, with an overall average high enough to stay in school

-
- 1** b. Average or better in every course
c. Very good in every course except possibly one
d. Excellent in every course

Q42. In comparison with most of the people I know, I am able to give a talk before a group:

- 1** a. Much more easily
b. Somewhat more easily
c. Just as easily

-
- 0** d. A little less easily
e. Much less easily

Q43. Compared to others my age, I think my athletic abilities are:

- 1 a. In the top 1%
- b. In the top 5%
- c. In the top 25%

- 0 d. Average
- e. Below average

Q44. Naval Academy students sometimes leave before receiving their commission. If this should happen do you, which of the following do you think would be the most likely cause?

- 1 a. Not applicable, I am absolutely certain I will obtain a commission
- b. Change to a major not offered at the Naval Academy
- c. Lack of ability for military service

- 0 d. Lack of academic ability or necessary study skills
- e. Other

Q55. In comparison with most of the people I know, I am able to make new friends:

- 1 a. Much more easily
- b. A little more easily
- c. As easily as other people

- 0 d. A little less easily
- e. Less easily

Military Lifestyle Score (MILIF_GR): The Military Lifestyle variable describes a candidate's comfort level with a military environment. More specifically it identifies a midshipman's outlook on leadership, security, discipline, organization, and the importance of forethought. The military lifestyle variable is assigned a negative expected sign based on the theory that a high score is indicative of a person who is a "good fit" for a military environment.

The numeric score for the military lifestyle variable is derived from a summation of a candidate's responses to the following eight questions from the PHQ survey.

Figure 9. Questions Used in the Military Lifestyle Variable

Q26. Compared to most people my age, I think I will get used to military life:

- 1 a. Much more easily

- 0 b. A little more easily
- c. About as easily
- d. A little less easily
- e. Less easily

Q30. This question was preceded by the following two sentences.

"Listed below are some of the traditional advantages of a military career and a Naval Academy education. Using the following scale, indicate how important each item was in your decision to consider a military career."

Q30. Opportunities to direct others, have responsibilities and authority

- 1** a. Extremely important
b. Very important
-
- 0** c. Important
d. Rather unimportant
e. Very unimportant

Q37. & Q39. These questions were preceded by the following sentence.

"Using the following scale, indicate how important it is to you personally, to pursue each of the goals listed below."

Q37. An exciting life

- 1** a. Extremely important
b. Very important
-
- 0** c. Somewhat important
d. Somewhat unimportant
e. Very unimportant

Q39. Family security

- 1** a. Extremely important
b. Very important
-
- 0** c. Somewhat important
d. Somewhat unimportant
e. Very unimportant

Q45. What kind of upbringing did you have?

- 1** a. Strict but fair
b. Strict but unfair
-
- 0** c. Inconsistent
d. Not very strict but fair
e. Not very strict but unfair

Q67, Q73, & Q74 These questions were preceded by the following sentence.

"Using the following scale, indicate the extent to which each of the statements below applies to you."

Q67. I feel that people who can't meet deadlines just aren't organized

- 1** a. Very characteristic of me
b. Somewhat characteristic of me
-
- 0** c. Slightly characteristic of me
d. Somewhat uncharacteristic of me
e. Very uncharacteristic of me

Q73. When an opportunity arises to have a good time, I take it and don't worry about the consequences

- 0 a. Very characteristic of me
b. Somewhat characteristic of me
c. Slightly characteristic of me
-
- 1 d. Somewhat uncharacteristic of me
e. Very uncharacteristic of me

Q74. When I want to achieve something, I set sub-goals and consider specific means for achieving those goals

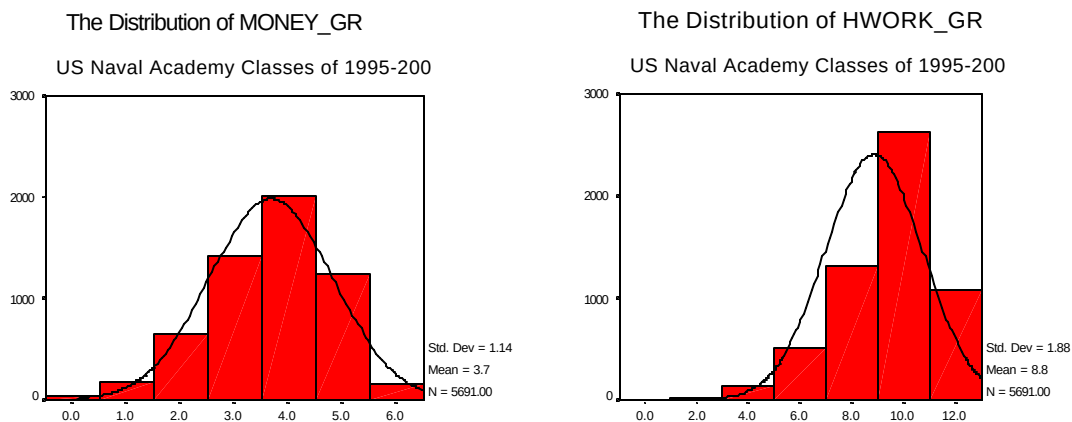
- 1 a. Very characteristic of me
b. Somewhat characteristic of me
c. Slightly characteristic of me
-
- 0 d. Somewhat uncharacteristic of me
e. Very uncharacteristic of me

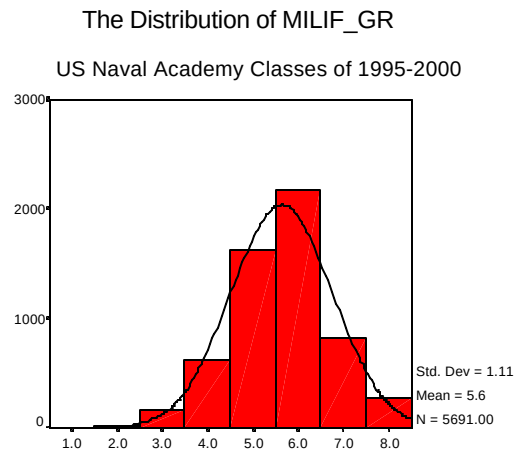
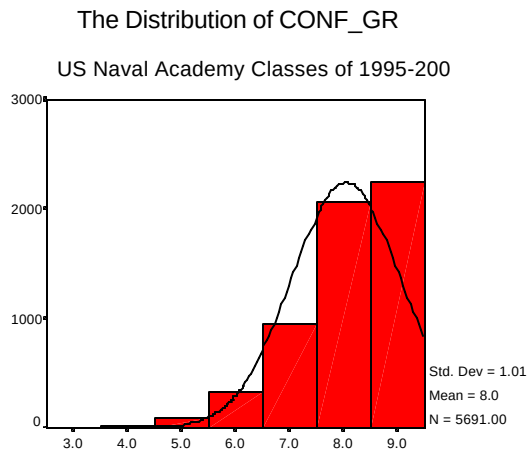
Table 13 and Figure 10, below, provide a cursory statistical description and graphic representation of the PHQ variables. Because these variables were developed to assist in predicting attrition, all four are assigned a negative expected sign. That is, the higher the score for each variable, the less likely that student will attrite.

Table 13. PHQ Data Descriptive Statistics

	Expected Sign	Minimum	Maximum	Mean	Std. Deviation
MONEY_GR	-	.00	6.00	3.6755	1.1447
HWORK_GR	-	.00	11.00	8.8466	1.8806
CONF_GR	-	3.00	9.00	8.0457	1.0119
MILIF_GR	-	1.00	8.00	5.6371	1.1140

Figure 10. Graphic Representation of PHQ Variable Distributions





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IV. DATA ANALYSIS

A. INTRODUCTION

The purpose of this chapter is to provide the reader with the results of the binary logistic regressions run using the data from the classes of 1995-1999 and to show the ability of those regression results to predict attrition for the class of 2000.

The following dependent variables from the data set containing information from the classes of 1995-1999 are modeled: overall attrition, voluntary attrition, academic attrition, and performance/conduct attrition. Each of the four forms of attrition are analyzed using the following models: a base model, an MBTI augmented model, a PHQ augmented model, and a combined model that is augmented by both MBTI and PHQ information. The results of these sixteen regressions are also used to predict the four modes of attrition for the class of 2000.

Initially a comparison is made between the actual and expected signs (showing positive or negative correlation) relating the independent and dependent variables. Since this study models attrition, positive correlations infer a greater tendency to attrite whereas negative correlations infer a reduced tendency to attrite. Along with this comparison is a brief discussion of the consistency and significance of the independent variables' relationship to the various modes of attrition.

B. CAREER INTEREST SCORE LOGIT MODEL RESULTS

Prior to running the 16 regressions referred to above, it is necessary to run the regressions using the baseline model and the Career Interest Score. This is necessary to test the ability of the CIS in predicting attrition. The CIS is never significant in the four regressions below (Table 14). Based on the literature review and initial findings of this study the CIS variable is not used in further versions of the model.

Table 14. Logistic regression Results Base Model + CIS Classes of 1995-1999

	Overall		Voluntary		Academic		Perf/Con	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
SATM_HI	-0.0014	0.0595	-0.0007	0.4326	-0.0053	0.0020	-0.0016	0.3791
SATV_HI	0.0009	0.1514	0.0008	0.2498	0.0013	0.3293	0.0010	0.5143
RSO_COMB	-0.0014	0.0008	-0.0006	0.1978	-0.0037	0.0000	-0.0028	0.0053
HS_OFFIC	-0.0014	0.0002	-0.0008	0.0694	-0.0043	0.0000	-0.0018	0.0608
MALE	-0.5900	0.0000	-0.7367	0.0000	0.0712	0.7932	-0.3995	0.1100
HISPANIC	0.4673	0.0005	0.0497	0.7759	1.1790	0.0000	1.1437	0.0000
AFRICAN	0.4410	0.0022	-0.2088	0.3029	1.2597	0.0000	1.1655	0.0000
ASIAN	-0.3229	0.1146	-0.6318	0.0154	0.7805	0.0248	-0.3920	0.5098
NATIVE	0.1422	0.6821	0.1112	0.7778	0.4528	0.5425	-0.0693	0.9460
CIS_STD	-0.0002	0.6025	-0.0003	0.4405	0.0007	0.4035	-0.0006	0.4906
Constant	1.6457	0.0087	0.0762	0.9163	4.3430	0.0025	0.9762	0.5249
Chi-square	104		61		135		53	
-2 Log Likelihood	4670		3700		1240		1090	
% Predicted Correct*	12.4%		6.7%		2.8%		1.6%	

* These percentages represent the total percent of the data set correctly predicted to attrite

C. FOUR-VERSION MODEL LOGISTIC REGRESSIONS RESULTS

The regression tables found in the next four sections each contain the output for all four versions of the attrition model. For each type of attrition the four regressions are shown side-by-side to facilitate comparison. From left to right the base model, the MBTI augmented model, the PHQ augmented model, and the fully augmented model are displayed. Variables showing significant correlation are boldfaced.

1. Overall Attrition: Classes of 1995-1999

Table 15 contains the logistic regressions results of the four-version model and overall attrition. The base model provides a good starting point for a discussion of the results. Only two of the four performance variables used in the base model prove significant when modeling overall attrition. SAT math and SAT verbal are both insignificant. Additionally, SAT verbal has a positive sign. This means that the higher a candidate's SAT verbal score, the more likely he or she will attrite. This result is surprising because it runs counter to the theory used to develop the admissions multiple. In the Whole Person Multiple, the higher a candidate's SAT score (math or verbal) the higher their multiple score. The Naval Academy places great value in a candidate's SAT scores. SAT math and verbal scores account for 24 and 12 percent of the Multiple score respectively. However, the model shows SAT math to be insignificant and shows SAT verbal to be insignificant and of the wrong sign. Perhaps this is because overall attrition

includes all forms of attrition, and although one would suspect SAT scores to be significant when modeling academic attrition, the combination of results from the voluntary and performance conduct attrition models may mask their significance in the overall model. Rank of School Officials (RSO_COMB) and High School Official Rank (HS_OFFIC) are both significant and of the expected sign. One must ask why these performance variables prove highly significant when modeling overall attrition, while SAT scores were not. These variables represent a much larger slice of a candidate's personality and ability than SAT scores do. Specifically, the class rank variable (HS_OFFIC) is not just a measure of a candidate's academic ability; it also measures, to some degree, their work ethic, their personality, and their ability to manage time. For this reason, it is expected to be significant and negative in sign for more than just academic attrition. The combined rank of school officials is also more than a single dimension variable. It too measures more than academic ability, it measures performance, personality, work ethic, and social skills. For these reasons, RSO_COMB is also expected to be significant and negative in sign.

Gender also proves highly significant in the overall attrition base model and remains so through all subsequent versions. The sign for gender is negative as expected. This means that males are less likely to attrite overall. Although the women selected to the Naval Academy are highly qualified, many, including Naval Academy staff, believe that women have not yet been integrated as well as they could be and as such are at a disadvantage and more likely to attrite.

The results of the base model regression show that only the Hispanic and African American ethnicity variables are significant. Three of the four ethnicity variables, Hispanic, African American, and Native American have positive signs. This suggests that all three ethnic groups are more likely to attrite than Caucasians. This higher likelihood to attrite can be attributed, in part, to their lower academic ability as shown by their lower mean scores on each of the performance variables. Conversely, Asian Americans have a negative sign which means that they are less likely than Caucasians to attrite. This is due, in part, to their increased academic ability compared to the majority (Caucasians) as shown by their higher mean scores on each of the performance variables. The Asian American variable becomes significant whenever PHQ data is added to the

model. This suggests that the PHQ scales measure the cultural characteristics that make Asian Americans successful.

Within the fully augmented model, all four MBTI variables have the expected negative sign. Three of the four MBTI variables are significant with S score being the only insignificant variable. S score also carries the lowest coefficient amongst the MBTI scores. This taken with the fact that the sensing-intuiting continuum is the most closely divided within the data set (52.6% - 47.4%) may be an initial indication that the S score variable will be of little significance in future regressions. The significance and weights of the MBTI variables does not change appreciably when modeled alone or with the addition of the PHQ variables. This suggests that for overall attrition, the MBTI variables are not affected by the addition of PHQ variables.

All four of the PHQ variables also have negative signs. Additionally, three of the four PHQ variables are significant when modeled alone with the base model. When combined with the MBTI variables in the fully augmented model, only two PHQ variables maintain their significance. Specifically, the confidence variable loses its significance in the fully augmented model and the coefficient of the hard work variable, although not significant in either mode, is reduced. This suggests that these two variables, which measure a candidate's drive, determination, work ethic, and self-image, are somehow co-linear with items contained in the four MBTI variables.

Table 15. Logistic Regression Results - Overall Attrition

Overall Attrition Classes of 1995-1999								
	1st Version Base Model		2nd Version Base Model + MBTI		3rd Version Base Model + PHQ		4th Version Base+MBTI & PHQ	
	Coef	Sig	Coef	Sig	Coef	Sig	Coef	Sig
SATM_HI	-0.0014	0.0541	-0.0016	0.0326	-0.0014	0.0632	-0.0015	0.0511
SATV_HI	0.0009	0.1365	0.0004	0.5533	0.0010	0.1171	0.0005	0.4804
RSO_COMB	-0.0014	0.0008	-0.0013	0.0022	-0.0013	0.0031	-0.0012	0.0043
HS_OFFIC	-0.0015	0.0001	-0.0015	0.0001	-0.0013	0.0007	-0.0014	0.0003
MALE	-0.5955	0.0000	-0.6086	0.0000	-0.5993	0.0000	-0.5958	0.0000
HISPANIC	0.4698	0.0005	0.4084	0.0029	0.4207	0.0020	0.3678	0.0075
AFRICAN	0.4437	0.0020	0.3935	0.0069	0.3073	0.0364	0.2937	0.0478
ASIAN	-0.3211	0.1166	-0.3409	0.0989	-0.4164	0.0434	-0.4230	0.0417
NATIVE	0.1440	0.6784	0.0703	0.8417	0.0850	0.8084	0.0300	0.9326
ESCORE	-	-	-0.0063	0.0000	-	-	-0.0055	0.0002
SSCORE	-	-	-0.0025	0.1194	-	-	-0.0026	0.0961
TSCORE	-	-	-0.0052	0.0020	-	-	-0.0056	0.0010
JSCORE	-	-	-0.0072	0.0000	-	-	-0.0064	0.0000
MONEY_GR	-	-	-	-	-0.1276	0.0003	-0.1257	0.0005
HWORRK_GR	-	-	-	-	-0.0406	0.0523	-0.0108	0.6165
CONF_GR	-	-	-	-	-0.0904	0.0211	-0.0687	0.0846
MILIF_GR	-	-	-	-	-0.1169	0.0019	-0.1267	0.0009
Constant	1.5590	0.0100	2.0833	0.0009	3.5081	0.0000	3.6712	0.0000
Chi-square	104		185		143		212	
-2Log likelihood	4670		4590		4630		4560	
% Predicted Correct*	12.5%		12.8%		12.5%		13.0%	

* These percentages represent the total percent of the data set correctly predicted to attrite

2. Voluntary Attrition: Classes of 1995-1999

Table 16 contains the logistic regression results of the four-version model and voluntary attrition. The first item worthy of discussion is the lack of significance of the performance variables. The variables all keep the same signs as they had for overall attrition, however none of them are significant in the base model. This is not unexpected. There was no expectation for performance variables to possess the ability to predict voluntary attrition. Of interest, however, is the high school official rank variable. It becomes significant whenever MBTI variables are added to the model.

The gender variable remains significant, negative in sign, and consistent across the four versions of the model. However, the value of the gender coefficient is larger than it is for overall attrition and is larger than any other coefficient in the voluntary attrition model. Clearly, this data suggests that gender is indeed an issue when considering voluntary attrition. This does not appear to be due to any major difference in

academic ability, but may be due to the levels of gender bias that may still exist at the Naval Academy.

The ethnicity variables in the base model show only the Asian American variable is significant. Additionally, the Hispanic and African American variables are no longer significant and the African American variable has changed in sign. This change in significance and sign from the overall model suggests that African Americans overall propensity to attrite is the result of reasons other than those associated with voluntary attrition. Again, Asian Americans are the least likely to attrite. Unlike the overall model, Asian Americans remain significant through all four versions of the model. The same conclusion made for Hispanics and African Americans can be made here for Asians. Asian Americans who attrite do so for reasons other than those associated with voluntary attrition.

When MBTI information is added to the model, only the E, T, and J variables prove significant. These results are in keeping with the conclusions drawn from the initial overall attrition regression results. Again, all three MBTI variables remain significant, consistent in sign, and of similar value across all four versions of the model. The MBTI remains unchanged when combined with PHQ variables in the fully augmented model. The same cannot be said for the PHQ variables. When added alone to the base model, only the MONEY_GR and CONF_GR variables prove significant. MILIF_GR (military Lifestyle) is no longer significant as it was for overall attrition. This suggests that the military lifestyle variable will be significant for some other form of attrition. Additionally, the confidence variable becomes insignificant when MBTI variables are combined with the PHQ variables in the fully augmented model. The money variable, which is comprised of questions that deal with a candidate's level of responsibility, their opinions on money, and their ability to manage time, proved significant whenever it appeared in the voluntary attrition model. This suggests candidates who are able to excel in school and maintain a paying job that allows them to provide for a portion of their own welfare, are less likely to attrite. In this manner, the money variable is able to capture to some degree the maturity level and persistence of the candidate.

The in-sample attrition classification improves appreciably from 6.6% to 9.7% between the base and fully augmented voluntary attrition models. As the base model is augmented, each successive model does add significant variables. From left-to-right two, six, four, and seven variables prove to be significant.

Table 16. Logistic Regression Results - Voluntary Attrition

Voluntary Attrition Classes of 1995-1999								
	1st Version Base Model		2nd Version Base Model + MBTI		3rd Version Base Model + PHQ		4th Version Base+MBTI & PHQ	
	Coef	Sig	Coef	Sig	Coef	Sig	Coef	Sig
SATM_HI	-0.0007	0.4010	-0.0009	0.2750	-0.0006	0.5150	-0.0007	0.4174
SATV_HI	0.0009	0.2200	0.0003	0.7350	0.0010	0.1615	0.0004	0.6167
RSO_COMB	-0.0006	0.1954	-0.0005	0.3124	-0.0006	0.2528	-0.0005	0.2928
HS_OFFIC	-0.0008	0.0620	-0.0010	0.0320	-0.0008	0.0866	-0.0010	0.0255
MALE	-0.7461	0.0000	-0.7785	0.0000	-0.7328	0.0000	-0.7527	0.0000
HISPANIC	0.0544	0.7555	-0.0246	0.8897	0.0150	0.9319	-0.0541	0.7611
AFRICAN	-0.2019	0.3187	-0.2975	0.1476	-0.3074	0.1344	-0.3590	0.0848
ASIAN	-0.6286	0.0159	-0.6562	0.0126	-0.7086	0.0069	-0.7111	0.0070
NATIVE	0.1144	0.7716	-0.0145	0.9711	0.0644	0.8713	-0.0374	0.9261
ESCORE	-	-	-0.0105	0.0000	-	-	-0.0102	0.0000
SSCORE	-	-	-0.0013	0.4600	-	-	-0.0015	0.4214
TSCORE	-	-	-0.0077	0.0001	-	-	-0.0079	0.0001
JSCORE	-	-	-0.0082	0.0000	-	-	-0.0081	0.0000
MONEY_GR	-	-	-	-	-0.1293	0.0017	-0.1251	0.0029
HWORR_GR	-	-	-	-	-0.0137	0.5780	0.0257	0.3116
CONF_GR	-	-	-	-	-0.1165	0.0100	-0.0738	0.1108
MILIF_GR	-	-	-	-	-0.0723	0.0975	-0.0787	0.0755
Constant	-0.0736	0.9161	0.6352	0.3806	1.6039	0.0459	1.7210	0.0377
Chi-square	60		161		81		175	
-2Log likelihood	3700		3600		3680		3590	
% Predicted Correct	6.65		6.6%		8.3%		9.7%	

* These percentages represent the total percent of the data set correctly predicted to attrite voluntarily.

3. Academic Attrition: Classes of 1995-1999

Table 17 contains the logistic regression results for academic attrition and the four-version model. Three of the four performance variables prove significant. When comparing the academic base model to the overall base model one notices that SAT math has become significant as expected, but SAT verbal is still insignificant and of the opposite sign. One would expect SAT verbal to be as important in predicting attrition as SAT math. This finding does not support the conclusion made in the overall attrition section, which suggested that the SAT verbal variable was not significant in that model

because other forms of attrition were masking its ability to predict academic attrition. In attempting to explain the reason for this unexpected result, an in depth analysis of the relationships between the SAT variables and the remainder of the model variables was conducted. The authors were unable to identify any reason why the SAT verbal variable is insignificant and of the opposite sign when used to predict academic attrition.

The gender variable proves insignificant when used to predict academic attrition. This result, when combined with the extremely high significance of the gender variable in the voluntary attrition model, suggests that gender's significance in the overall attrition model is due to its significance in the voluntary model. Clearly, gender is not an issue when it comes to academic ability and more specifically, academic attrition.

The ethnic variable regression results for academic attrition are distinctly different than those found in the voluntary model. In the voluntary model, only Asian Americans were significant with a negative sign. In the case of academic attrition, all four ethnic variables are positive in sign and three of the four are extremely significant. Only the Native American variable proves insignificant. The sign and significance of the Hispanic and African American variables is not unexpected. Both were significant and of positive sign in the overall attrition model. Asian Americans, however, were neither significant nor positive in sign in the overall model. Such a drastic sign switch is unexpected. Perhaps this information combined with the strongly negative and significant relationship between Asian Americans and voluntary attrition suggests that Asian Americans have academic difficulty, but are unwilling to voluntarily resign. This would be in keeping with society's general perception of the Asian culture's work ethic and their beliefs pertaining to one's personal honor. The data supports this conclusion by suggesting that Asian Americans are unwilling to give up and leave the institution voluntarily, but instead will persist until the institution removes them. Additionally, the Hispanic and African American variables have extremely large coefficients. This suggests that these two ethnic minorities, in particular, are much more likely to attrite for academic reasons than the Caucasian majority. This tendency to attrite academically accounts for their significance in the overall model.

The MBTI information proves insignificant when used to model academic attrition. This is not an unexpected result just as the insignificance of performance variables in predicting voluntary attrition was not unexpected. All MBTI variables although insignificant for all four versions of the model, maintain the correct sign. Surprisingly, two of the four PHQ variables prove significant and of the correct sign when used to model academic attrition. The hard work variable is moderately significant, and, the military lifestyle variable is highly significant. The reason for the variable's significance in this case is a result of the types of questions that make up each of the two scales. The hard work variable contains questions that attempt to quantify a candidate's work ethic, persistence, and dedication. Candidates who score high on this variable represent extremely hard workers who refuse to give up. These types of individuals tend to succeed in the Naval Academy's unique military-academic environment where effort, persistence, and good time management can be the difference between letter grades. The military lifestyle variable attempts to gauge a candidate's likelihood to "fit" the institutional lifestyle by assessing their maturity, perception of self, and their affinity to exist in a structured military environment. This background information helps explain how this personality variable could be a significant predictor of academic success at the Naval Academy. Candidates with high military lifestyle scores expend little or no effort dealing with or growing accustomed to the military environment, in which they are forced to pursue their studies, and therefore, are more likely to succeed academically and are less likely to attrite for academic reasons.

In-sample attrition classification does not appreciably improve as variables are added to the model. However, as the base model is augmented, each successive model does add significant variables. From left-to-right six, six, six, and eight variables prove to be significant.

Table 17. Logistic Regression Results - Academic Attrition

Academic Attrition Classes of 1995-1999								
	1st Version Base Model		2nd Version Base Model + MBTI		3rd Version Base Model + PHQ		4th Version Base+MBTI & PHQ	
	Coef	Sig	Coef	Sig	Coef	Sig	Coef	Sig
SATM_HI	-0.0052	0.0023	-0.0052	0.0023	-0.0055	0.0014	-0.0053	0.0019
SATV_HI	0.0013	0.3518	0.0009	0.5364	0.0012	0.3771	0.0008	0.5472
RSO_COMB	-0.0037	0.0000	-0.0037	0.0000	-0.0033	0.0001	-0.0034	0.0001
HS_OFFIC	-0.0043	0.0000	-0.0041	0.0000	-0.0039	0.0000	-0.0037	0.0001
MALE	0.0863	0.7501	0.1022	0.7095	0.0678	0.8045	0.1157	0.6766
HISPANIC	1.1724	0.0000	1.1531	0.0000	1.1357	0.0000	1.1291	0.0000
AFRICAN	1.2495	0.0000	1.2571	0.0000	1.0422	0.0000	1.0906	0.0000
ASIAN	0.7766	0.0255	0.8100	0.0205	0.6668	0.0578	0.6956	0.0492
NATIVE	0.4466	0.5476	0.4588	0.5375	0.3238	0.6674	0.3708	0.6217
ESCORE	-	-	0.0031	0.3666	-	-	0.0057	0.1033
SSCORE	-	-	-0.0050	0.1564	-	-	-0.0059	0.1025
TSCORE	-	-	-0.0012	0.7611	-	-	-0.0018	0.6372
JSCORE	-	-	-0.0058	0.0717	-	-	-0.0030	0.3769
MONEY_GR	-	-	-	-	-0.0900	0.2491	-0.0817	0.2966
HWORKE_GR	-	-	-	-	-0.1089	0.0108	-0.1048	0.0173
CONF_GR	-	-	-	-	-0.0665	0.4118	-0.0827	0.3147
MILIF_GR	-	-	-	-	-0.2700	0.0009	-0.2834	0.0006
Constant	4.6619	0.0008	4.8041	0.0007	7.6616	0.0000	7.7880	0.0000
Chi-Square	134		146		162		173	
-2Log Likelihood	1240		1230		1210		1200	
% Predicted Correct*	2.8%		2.8%		2.9%		2.9%	

* These percentages represent the total percent of the data set correctly predicted to attrite academically.

4. Performance/Conduct Attrition: Classes of 1995-1999

Table 18 shows the logistic regression results of performance/conduct attrition and the four-version model. The only performance variable that proves significant in modeling performance/conduct attrition is the combined rank of school official variable. The RSO variable's ability to predict performance/conduct attrition is a result of the questions that make up the RSO score. The RSO survey asks teachers their opinion of a candidate's academic ability, study habits, work ethic, personality, and demeanor. The score is derived from the teacher's opinion of the "whole candidate". Therefore, those candidates with high RSO scores are unlikely to have a history of, or tendency to display aberrant behavior and are therefore, less likely to attrite for performance/conduct reasons.

Once again, the gender variable is insignificant. This finding supports the findings from the voluntary attrition section, which stated that the gender variables significance in the voluntary attrition model accounted for its significance in the overall attrition model. Only two of the four ethnicity variables prove significant. The Asian American and Native American variables, although insignificant, have a negative sign. The Hispanic and African American variables are both significant and positive in sign. This means that Hispanics and African Americans are more likely to attrite for performance/conduct reasons than the Caucasian majority. These results suggest that the significance of the Hispanic and African American variables in the overall attrition model is not just a result of their significance in the academic model but is a result of their combined significance in the academic and performance/conduct models.

Unexpectedly, the personality variables are, for the most part, insignificant when used to predict performance/conduct attrition. The only significant personality variables in the performance/conduct model are the E score and money variables. The E score variable is significant but of the wrong sign. More specifically, candidates with a high E score, although less likely to attrite overall, are more likely to attrite for performance/conduct reasons. This is understandable. Extraverts tend to be social and outspoken individuals who would be more likely to find themselves in a bad situation than introverts who kept to themselves and avoided social interaction. This explains the significance and sign change of the E score variable. The money variable's significance is also explainable. The money variable contains questions that attempt to measure a candidate's work history, their level of responsibility, and their ability to effectively manage commitments. It makes sense then that those individuals with high money scores have proven themselves responsible and efficient at managing commitments. These characteristics oppose the aberrant behavior implied in the performance/conduct attrition variable. Therefore, it makes sense that individuals with high money scores would be less likely to attrite for performance/conduct reasons.

In sample attrition classification does not appreciably improve across models. As the base model is augmented, successive models show inconsistent change. From left to right the performance/conduct regressions have three, three, four, and five significant variables.

Table 18. Logistic Regression Results -Performance/Conduct Attrition

Performance/Conduct Attrition Classes of 1995-1999								
	1st Version Base Model		2nd Version Base Model + MBTI		3rd Version Base Model + PHQ		4th Version Base+MBTI & PHQ	
	Coef	Sig	Coef	Sig	Coef	Sig	Coef	Sig
SATM_HI	-0.0017	0.3572	-0.0017	0.3505	-0.0018	0.3226	-0.0017	0.3503
SATV_HI	0.0011	0.4794	0.0007	0.6320	0.0011	0.4541	0.0009	0.5687
RSO_COMB	-0.0028	0.0054	-0.0027	0.0075	-0.0026	0.0101	-0.0025	0.0133
HS_OFFIC	-0.0018	0.0547	-0.0016	0.1044	-0.0017	0.0800	-0.0014	0.1436
MALE	-0.4167	0.0936	-0.4136	0.1023	-0.4627	0.0651	-0.4334	0.0895
HISPANIC	1.1507	0.0000	1.1630	0.0000	1.0996	0.0000	1.1127	0.0000
AFRICAN	1.1769	0.0000	1.2143	0.0000	1.0260	0.0004	1.0865	0.0002
ASIAN	-0.3856	0.5162	-0.3453	0.5621	-0.4889	0.4125	-0.4596	0.4423
NATIVE	-0.0626	0.9511	-0.0200	0.9844	-0.1948	0.8496	-0.1237	0.9042
ESCORE	-	-	0.0068	0.0706	-	-	0.0080	0.0361
SSCORE	-	-	-0.0061	0.1181	-	-	-0.0064	0.1041
TSCORE	-	-	0.0029	0.4849	-	-	0.0021	0.6168
JSCORE	-	-	-0.0043	0.2315	-	-	-0.0024	0.5052
MONEY_GR	-	-	-	-	-0.1808	0.0337	-0.1760	0.0389
HWORK_GR	-	-	-	-	-0.0596	0.2245	-0.0585	0.2469
CONF_GR	-	-	-	-	0.0079	0.9363	-0.0227	0.8214
MILIF_GR	-	-	-	-	-0.1643	0.0791	-0.1727	0.0663
Constant	0.6871	0.6429	0.5880	0.6988	2.5711	0.1317	2.5922	0.1326
Chi-Square	53		63		63		73	
-2Log Likelihood	1090		1080		1080		1070	
% Predicted Correct*	1.6%		1.9%		1.8%		1.9%	

* These percentages represent the total percent of the data set correctly predicted to attrite for performance/conduct reasons.

D. OUT-OF-SAMPLE PREDICTION RESULTS

The following sections provide information on the ability of the class of 1995-1999 regression results to predict attrition in the class of 2000. The percentages found in tables 19-22 were derived through the application of the beta weights (significance values) from the 1995-1999 regressions to the class of 2000 data. The out-of-sample predictions were done to assess the ability of the four-version model to use historical data to predict attrition for an incoming class. The results of the in-sample regressions for the class of 2000 can be found in Appendix B. A comparison of the values found in tables 19-22 to the overall percent correct values found in Appendix B (tables A-2, A-4, A-6, & A-8) provide the reader the ability to asses how well the four-version model predicts attrition both in and out of sample. Each of the tables below shows four results. The percentages, displayed from left to right, reflect the correctly predicted cases obtained

from the base model, the base model plus CIS, the MBTI augmented model, the PHQ augmented model, and the fully augmented model. The four forms of attrition: overall, voluntary, academic, and performance/conduct are presented in order.

1. Overall Attrition Out-of-Sample Predictions

As personality information is added to baseline information the model becomes better able to predict overall attrition in the class of 2000. The fully augmented model provides a slight improvement over the other three models for predicting overall attrition

Table 19. Overall Attrition Classification Table - Out of Sample

	Base Model	Base Model + CIS	Base Model + MBTI	Base Model + PHQ	Base Model + MBTI & PHQ
% Predicted Correct	12.0%	12.3%	13.1%	13.5%	13.6%

NOTE: These percentages represent the total percent of the data set correctly predicted to attrite. The actual overall attrition rate for the Class of 2000 is 20.9%.

2. Voluntary Attrition Out-of-Sample Predictions

As personality information is added to the base voluntary attrition model, the model's predictive power rises by roughly 50% from 7.2% to over 10%. Again, the fully augmented model marks a slight improvement over the other three models for predicting voluntary attrition.

Table 20. Voluntary Attrition Classification Table - Out of Sample

	Base Model	Base Model + CIS	Base Model + MBTI	Base Model + PHQ	Base Model + MBTI & PHQ
% Predicted Correct	7.2%	7.7%	10.4%	10.0%	11.3%

NOTE: These percentages represent the total percent of the data set correctly predicted to attrite voluntarily. The actual voluntary attrition rate for the Class of 2000 is 16%.

3. Academic Attrition Out-of-Sample Predictions

Unlike in the voluntary attrition models, personality information adds no predictive power to academic deficiency models. Apparently, personality variables are only related to non-academic attrition models.

Table 21. Academic Attrition Classification Table - Out of Sample

	Base Model	Base Model + CIS	Base Model + MBTI	Base Model + PHQ	Base Model + MBTI & PHQ
% Predicted Correct	2.4%	2.5%	2.3%	2.1%	1.5%

NOTE: These percentages represent the total percent of the data set correctly predicted to attrite academically. The actual academic attrition rate for the Class of 2000 is 4.1%.

4. Performance/Conduct Attrition Out-of-Sample Predictions

Again, the addition of personality information does not appreciably increase the predictive power of the performance/conduct model.

Table 22. Performance/Conduct Attrition Classification Table - Out of Sample

	Base Model	Base Model + CIS	Base Model + MBTI	Base Model + PHQ	Base Model + MBTI & PHQ
% Predicted Correct	0.9%	0.9%	0.9%	1.0%	1.3%

NOTE: These percentages represent the total percent of the data set correctly predicted to attrite for performance/conduct reasons. The actual performance/conduct attrition rate for the Class of 2000 is 3%.

In summary, personality variables appear to have a marginal effect on raising the predictive power of the overall and voluntary attrition models. They literally added no value to the academic and performance/conduct attrition models.

E. CHAPTER SUMMARY

The regression results for the classes of 1995-1999 show that the personality information contained in the MBTI and PHQ is significant. The results show that the addition of personality information enables the basic Whole Person Multiple formula to capture a larger percentage of attrition for two of the four attrition types modeled. This correspondence between personality information and attrition is in keeping with the expected results discussed in chapter three. Unlike the CIS, which is never significant, the MBTI and PHQ do add significant information to two of the four attrition models.

1. A Review of the In-sample (1995-1999) Regression Results

A close review of the in-sample regression outputs reveals information about the performance variables, the control variables and the personality variables. The following sections provide a brief summary of each.

a. Performance Measures

-Higher math SAT scores always indicate a lower propensity for attrition though this is only significant when looking at overall and academic attrition.

-Interestingly, verbal SAT scores are never significant and are generally of the opposite sign.

-The rank of school official score always indicates a lower propensity for attrition and is also significant in every regression except for voluntary attrition.

-High school rank always indicates a lower propensity for attrition, and is significant in eleven of the sixteen regressions.

b. Demographic Information

-The gender (male) variable indicates that men are significantly less likely to attrite for voluntary reasons. This relationship between gender and voluntary attrition is so strong it makes the gender variable significant in the overall model. There is no significant relationship between gender and academic or performance/conduct attrition.

-The ethnicity variables provided multiple findings. First, Hispanics and African Americans are much more likely to attrite for academic and performance/conduct reasons than the Caucasian majority. Additionally, Asian Americans as an ethnic group are not likely to attrite voluntarily.

c. Personality Information

-The results show that personality variables produce a marginal improvement in the predictive ability of the overall and voluntary attrition models. They add no substantial predictive ability to the academic and performance/conduct models.

-MBTI data suggests that the E, T, and J variables provide the predictive power found in the MBTI when predicting overall and voluntary attrition. The S score variable is never significant in any of the four attrition models. None of the MBTI variables are significant when used to model academic attrition. Additionally, E score becomes significant only in the fully augmented version of the performance/conduct model.

-The PHQ variables are of the expected sign across all four attrition models. The money, confidence, and military lifestyle variables are significant when modeling overall attrition, however, the confidence variable loses significance when combined with MBTI data. The money and confidence variable are again significant when used to model voluntary attrition. Again, the confidence variable loses significance when combined with MBTI data in the fully augmented model. This suggests that the MBTI data does a better job of measuring those personality traits measured by the confidence variable.

2 The Ability to Predict out of Sample

The following table shows the percentage of attrition captured by each model for all four forms of attrition. For example, the overall attrition rate for the class of 2000 was 20.9%. The full model predicted 13.6% of the 20.9%. Therefore, the model correctly predicted 65.07% of the overall attrition for the class of 2000. The percentages appear in bold typeface when they represent the model which best predicted that type of attrition. For three of the four modes of attrition, the addition of personality variables results in the capture of a larger percentage of the out-of-sample attrition

Table 23. Attrition Prediction Summaries by Model for the Class of 2000

	Base Model	MBTI Model	PHQ Model	Full Model
Overall	57.42%	62.68%	64.59%	65.07%
Voluntary	45.00%	65.00%	62.50%	70.63%
Academic	58.54%	56.10%	51.22%	36.59%
Performance/ Conduct	30.00%	30.00%	33.33%	43.33%

V. CONCLUSIONS AND RECOMMENDATIONS

The purpose of this chapter is to provide the reader with conclusions, answers to the study's research questions, and recommendations for future research. Additionally, this chapter attempts to evaluate the practical implications of the results by addressing the possible costs of changing admissions procedures and the potential gains or losses such changes might create.

A. CONCLUSIONS

This section presents conclusions derived from an analysis of the regression outputs dealing with the CIS and the four-variation model and the out-of-sample prediction results for the class of 2000. Additionally this section provides answers to the research questions.

1. Statistical Findings

CIS is not significant for any of the four modes of attrition considered within this study. The regression results from the class of 1995-1999 dataset prove that personality measures are significant only when modeling overall and voluntary attrition. For two of the four modes of attrition, the out-of-sample prediction is most powerful when using the fully augmented model (baseline information + MBTI + PHQ). MBTI and PHQ information constructively add power to the model's ability in predicting overall, and voluntary out-of-sample attrition.

2. Addressing the Research Questions

The following paragraphs provide answers to the research questions from chapter one.

Question One:

Does the use of personality measures improve the Admission Board's ability to identify candidates who are likely to attrite from the United States Naval Academy and therefore, assist them in selecting those candidates who will persist through the four-year program?

The use of personality measures does improve the Admission Board's ability to identify candidates who are likely to attrite from the United States Naval Academy.

Although the current attrition predictor, the CIS, proved insignificant, the addition of the MBTI, PHQ, or both did improve the Multiple's ability to predict the two of the four modeled attrition variables. The CIS augmented model used in this study does show marginal improvement in predicting attrition in the out-of-sample class of 2000. However, this marginal improvement is not as large as the improvements shown in using the fully augmented models. Moreover, the sustained insignificance of the CIS should be cause for concern in light of its impact on the Whole Person Multiple and admissions decisions.

Question Two:

Would the addition of the Myers-Briggs Type Indicator in place of the Career Interest Score of the Strong Interest Inventory improve the Whole Person Multiple's ability to predict voluntary, academic, and performance/conduct attrition from the U.S. Naval Academy?

The addition of the Myers-Briggs Type Indicator in place of the CIS does improve the ability of the Whole Person Multiple to predict voluntary attrition. After removing the Strong Interest Inventory measures from the model, the base model captures 85% of the weight of the Whole Person Multiple. Adding MBTI information to the base model improves out-of-sample predictability for overall and voluntary attrition. There was no appreciable change in the model's ability to predict academic or performance/conduct attrition. Academic attrition was best predicted using only the baseline model.

Question Three:

Would the addition of the Personal History Questionnaire in place of the Career Interest Score of the Strong Interest Inventory improve the Whole Person Multiple's ability to predict voluntary, academic, and performance/conduct attrition from the U.S. Naval Academy?

The addition of the Personal History Questionnaire in place of the CIS does improve the ability of the Whole Person Multiple to predict attrition. Adding PHQ information to the base model improved out-of-sample predictability for overall, voluntary, and performance/conduct attrition. Academic attrition was best predicted using only the baseline model.

3. The Costs and Benefits of Incorporating Personality Information into the Admissions Process

a. Using the PHQ

Though no longer administered by the Naval Academy the PHQ could be used again. Its use would require some collaboration between the Naval Academy and NPRST. The PHQ was administered for at least ten years as part of every candidate's admissions paperwork. The data has not been analyzed outside the work done in support of this thesis. It is safe to assume that there is more for administrators and admissions staff to learn from this data. Though the actual dollar amount associated with administering this survey to all applicants is unknown, the statistical findings within this study suggest that re-instituting it as a part of the admissions process may be a worthwhile endeavor.

b. Using the MBTI

The MBTI is already administered to all midshipmen during Plebe Summer, shortly after they arrive at the Naval Academy. Currently it is used as a tool for self-assessment and awareness. Though the actual dollar amount associated with administering the MBTI to all applicants is unknown, the statistical findings within this study suggest that it is worth consideration as part of the admissions process.

c. Unknown Costs

Using personality measures to effectively filter the applicant pool may have certain unknown costs. Although the use of personality measures may produce less attrition, a decision to include a personality test as part of an admissions system does raise some philosophical issues. Additionally, the effects on the Brigade of Midshipmen that may result from the incorporation of personality measures in the admissions system are unknown. The short and long term impact of such a change are impossible to predict and should be seriously considered prior to implementation.

d. The Bottom Line of Improved Admissions

The results suggest that the use of personality measures could create marginal improvements in the admissions process. The results are not, however, overwhelming enough to suggest that the Naval Academy could appreciably decrease the

number of applicants it admits. Therefore, it is not anticipated that these improvements would appreciably lower the operating costs of the Naval Academy¹⁶. However, the Navy and Marine Corps use Officer Candidate School (OCS) to account for Naval Academy and NROTC attrition. Each OCS candidate costs the navy approximately \$35,000 dollars. Although the results of this thesis would not appreciably reduce costs at the Naval Academy, they could, due to reduced Naval Academy attrition, impact the number of candidates admitted to Navy and Marine Corps Officer Candidate School. This combined with the small savings experienced by the Naval Academy would lower the overall cost of officer recruitment by the Department of the Navy.

B. RECOMMENDATIONS

1. Further Research

a. The CIS

This study examines the CIS over a six-year period (1995-2000). One suggestion for further research is to re-examine the methodology used by NPRDC to develop the SII scales used by the Naval Academy. The SII may have a previously un-harnessed ability to predict Naval Academy attrition. If so, a new SII scale would provide the Naval Academy with an inexpensive solution to the problems attributed to the CIS. There may be statistically significant information available within the CIS and this should be closely examined before removing the CIS from the entire admissions process.

b. The PHQ & MBTI

Clearly there is statistically significant information available within the PHQ. A more thorough factor analysis needs to be performed on this survey. Statistical tests need to be used to identify correlations between the responses of a given question and attrition. A more statistically derived set of scales may show the PHQ to be even more predictive than shown by the results of this study.

It is also clear that the Naval Academy places a considerable amount of faith in the ability of the MBTI to educate midshipmen about themselves. There still exist a multitude of studies that could be done with the volumes of readily available

¹⁶ Although the price per graduate is above \$260,000, many of those costs are fixed costs that would only be affected if there were large changes in the number of applicants admitted

MBTI data maintained in the Naval Academy's data warehouse. Specifically, the MBTI's relationship to attrition at the Naval Academy is still a relatively unstudied field.

c. Other Personality Measures

Although the MBTI and the PHQ proved themselves significant in this study, there are other personality measures that are much more comprehensive. Research addressing the ability of a personality measure such as the 16PF¹⁷ to predict attrition would be quite beneficial to the Naval Academy.

If personality measures are to be used in the admissions process, administrators need to address their effect on specific minority types. Additional studies would be required to better understand the correlations between various ethnicities and attrition when viewed through the filter of a personality measure. These correlations may have profound effects on the diversity of the applicant pool. Moreover, the Naval Academy is required by law to maintain a diverse student body. Personality measures could possibly make that requirement more difficult to meet. Additional research is required.

2. Considerations for the Admissions Process

Table 27 below shows comparisons between the baseline model and the fully augmented model. These two models predicted group membership (either graduation or attrition) in the 1995-1999 data set. The first set of two rows show when both models correctly predicted graduation or attrition. The second set of two rows show when both models incorrectly predicted graduation or attrition. The third set of two rows show when only the base model correctly predicted graduation or attrition. The last set of two rows show when only the fully augmented model correctly predicted graduation or attrition. The fully augmented model captured 59 more graduates and 22 more cases of attrition. Out of the 4589 files within the 1995-1999 dataset this is nearly a 2% improvement over the baseline model's prediction.

¹⁷ The Sixteen Personality Factor Questionnaire (16PF) is an assessment from NCS Assessments. It is a self-report questionnaire that provides detailed information on 16 primary personality traits. It emphasizes an individual's strengths through measurement of such personality dimensions as warmth, intelligence, sensitivity, and self-discipline. The 16PF assessment is also a reliable predictor of normal personality and helps project an individual's fitness for a variety of occupations.

Table 24. Comparison of Model Classification Ability: Classes 1995-1999

Model Classification	Base Prediction	Base+MBTI+PHQ Prediction	Actual Outcome	Number of Cases	Total Cases
Both Models Correct	Grad	Grad	Grad	1672	2128
	Attrite	Attrite	Attrite	456	
Both Models Incorrect	Attrite	Attrite	Grad	1038	1306
	Grad	Grad	Attrite	268	
Base Model Correct	Grad	Attrite	Grad	418	537
	Attrite	Grad	Attrite	119	
Base+MBTI+PHQ Model Correct	Attrite	Grad	Grad	477	618
	Grad	Attrite	Attrite	141	

In light of this small difference it is not recommended that great weight be placed upon the findings of this study, nor should the admissions process be appreciably altered. The successful rate of graduation of nearly 80% is noteworthy and the result of a time-tested and well-balanced admissions process. Marginal improvements may be possible, but they should be approached and considered carefully.

MBTI and PHQ could be incorporated into the admissions process without being injected directly into the candidate multiple. The Admissions Board should consider developing a "Personality Measure RAB". This softer way of using personality information would allow the admissions board greater control and understanding of how personality measures impact candidates on an individual basis.

APPENDIX A PERSONAL HISTORY QUESTIONNAIRE

The purpose of this appendix is to present the Personal History Questionnaire to the reader as it would appear to an applicant. The following pages of the PHQ have been edited to depict the method used by the authors to organize the PHQ into four separate scales. Because it includes all 85 PHQ questions, it provides the reader with the opportunity to view the questions that were not used in any of the four scales.

The responses to the questions that were included in one of the four groups have a solid line separating responses and a zero or one next to the groups of responses to show which value those groups were assigned. Also, the name of the group to which the question belongs is listed beside it. Questions that were not used have an “X” over them or solid line through them.



PERSONAL HISTORY QUESTIONNAIRE

FORM PHQ-84A

THIS FORM SUBJECT TO THE
PRIVACY ACT OF 1974. SEE PAGE 8.

This survey consists of a number of questions about you, your family, your interests, and your experiences.

Read each question and all of its possible answers carefully. Being as frank as you can, quickly select the one answer that is most appropriate for you. Then mark the circle corresponding to that answer in the space provided in this questionnaire booklet. Be sure to select one answer — and only one answer — for every question.

Please mail your completed booklet promptly to the Naval Academy in one of the envelopes provided.

GENERAL INSTRUCTIONS	
• DO NOT USE FELT TIP, BALLPOINT OR INK PENS. • COMPLETELY BLACKEN CIRCLE. • MAKE CLEAN ERASURES. • MAKE NO STRAY MARKS. • DO NOT WRINKLE BOOKLET. • DO NOT SEPARATE BOOKLET PAGES.	CORRECT MARKS ● ● ● ● ● INCORRECT MARKS ○ × ○ × ○

Now turn the page and fill in your name and other identifying information.

	23c.
DO NOT MARK IN THIS AREA	

PAGE 2

MONEY1. When I first earned money on a regular basis (other than from members of my family), my age was:

- 0 ☐ A 12 or younger.
☐ B 13-14.
☐ C 15.
1 ☐ D 16 or older.
☐ E I haven't had a paid regular job.

MONEY2. How many hours a week have you usually worked on paying jobs since the beginning of the 11th grade? (Do not include summer jobs.)

- 0 ☐ A None.
☐ B 1 to 10 hours.
☐ C 11 to 15 hours.
1 ☐ D 16 to 20 hours.
☐ E More than 20 hours.

HWORKE. I usually do:

- 1 ☐ A Much more than I resolved to do.
☐ B A bit more than I resolved to do.
0 ☐ C Never less than what I resolved to do.
☐ D A little less than I resolved to do.
☐ E Much less than I resolved to do.

4. I would find a life in which one wouldn't have to work at all:

- ☐ A Very pleasant.
☐ B Pleasant.
☐ C Somewhat unpleasant.
☐ D Unpleasant.
☐ E Very unpleasant.

HWORKE. When doing something difficult:

- 0 ☐ A I give up very quickly.
☐ B I give up rather quickly.
☐ C I give up somewhat quickly.
☐ D I don't give up too soon.
1 ☐ E I usually see it through.

6. When I became interested in a military career, my age was:

- ☐ A 12 or younger.
☐ B 13 to 14.
☐ C 15.
☐ D 16.
☐ E 17 or older.

MONEY 7. During the last couple of years, the part of my own support that I personally earned was approximately:

- 0 ☐ A Less than 10%.
☐ B 10% to 30%.
1 ☐ C More than 30% but less than 60%.
☐ D 60% to 90%.
☐ E More than 90%.

8. The amount of influence the members of my family exercised on my career choice was:

- ☐ A A great deal; they exerted considerable pressure on me to accept their choice.
☐ B Some; they exerted moderate pressure on me to accept their choice.
☐ C A little; they encouraged me generally but left the choice up to me.
☐ D A great deal, but they did not try to pressure me to accept their choice.

9. Without any false modesty, I believe that highest rank that I could reach in the course Navy career is:

- ☐ A Lieutenant.
☐ B Commander.
☐ C Captain.
☐ D Admiral.
☐ E I don't know.

10. Other than those required for school, how many books do you usually read?

- ☐ A At least one a week.
☐ B Two or three a month.
☐ C About one a month.
☐ D About one every 6 months.
☐ E One or less a year.

11. Indicate the total number of semesters of advanced and honors mathematics courses, such as those listed below, that you expect to complete in junior and senior high school. Include all courses you have taken since beginning the seventh grade (summer courses also), but count each course only once.

- advanced algebra
 - advanced mathematics
 - analytic or coordinate geometry
 - trigonometry
 - independent study, seminars, or special clusters in mathematics
 - precalculus
 - calculus
 - computer programming
- ☐ A 5 or less.
☐ B 7-8.
☐ C 9-10.
☐ D 11-12.
☐ E 13 or more.

12. How often do you accomplish what you must do without having to be pushed to do it (by others)?

- 1 ☐ A Always.
☐ B Very often.
0 ☐ C Often.
☐ D Sometimes but not often.
☐ E Rarely.

TURN PAGE AND CONTINUE

13. Since I started high school, my money for recreation MONEY (or "extras") usually came from:

- 0 ☐ A Allowance and gifts from family.
☐ B Mostly allowance and gifts, some my own earnings.
☐ C Mostly my own earnings, some from the family.
1 ☐ D All from my own earnings.

14. If I wake up in the morning feeling a little "out of sorts" but don't feel really ill, I:

- ☐ A Don't go to school or work because it's possible that I might be coming down with something serious.
☐ B Go to school or work but take medicine "just in case" or let everyone know just how bad I feel.
☐ C Go to school or work without any unnecessary complaining but consider going home if I get noticeably worse.
1 ☐ D Go to school or work without hesitation because I consider that my responsibilities come first.

LISTED BELOW ARE SOME ACTIVITIES AND CONCERNS OF FIRST YEAR NAVAL ACADEMY STUDENTS. USING THE FOLLOWING SCALE, INDICATE HOW YOU ESTIMATE EACH ITEM WILL APPLY TO YOU DURING YOUR FIRST YEAR AT THE ACADEMY.

During my first year at the Academy I expect I will:

	HIGHLY IMPROBABLE	SOMEWHAT IMPROBABLE	SOMEWHAT PROBABLE	HIGHLY PROBABLE
15. Earn academic honors.	☐ A	☐ B	☐ C	☐ D
16. Earn honors in athletics.	☐ A	☐ B	☐ C	☐ D
17. Need tutoring in one course.	☐ A	☐ B	☐ C	☐ D
18. Earn military honors.	☐ A	☐ B	☐ C	☐ D
19. Have difficulties with studies or concentration.	☐ A	☐ B	☐ C	☐ D
20. Seek vocational or individual counseling.	☐ A	☐ B	☐ C	☐ D

21. Most Navy officers' jobs fall into one of the following categories: Surface Warfare, Submarine Warfare, Naval Aviation, and "Other" (such as Supply, Naval Intelligence, Public Affairs). Do you already know which of these areas you would like to go into?

- ☐ A Yes, I have known for a while.
☐ B Yes, I am almost sure.
☐ C Yes, but very tentatively.
☐ D No, I like them all equally.
☐ E No, I still don't know enough to decide.

22. If I have not attained my goal and have not done a task well then:

- 1 ☐ A I continue to do my best to attain the goal. **HWORK**
☐ B I exert myself once again to attain the goal.
0 ☐ C I find it difficult not to lose heart.
☐ D I'm inclined to give up.
☐ E I usually give up.

23. Of the following I feel that the thing I would like most in a job would be:

- ☐ A Promotion and pay according to ability.
☐ B Satisfactory vacations.
☐ C Good supervision.
☐ D Freedom to make decisions.
☐ E Working for myself.

24. The factor that was most responsible for my interest in a military career was:

- ☐ A Admiration for military heroes.
☐ B Educational benefits or job security.
☐ C The influence of close friends.
☐ D Advice from parents or guardians.
☐ E Personal preference over other careers.

25. The number of times per week I usually go out socially is:

- ☐ A 1 or less.
☐ B 2.
☐ C 3.
☐ D 4.
☐ E 5 or more.

26. Compared to most people my age, I think I will get used to military life:

- 1 ☐ A Much more easily. **MILIF**
☐ B A little more easily.
0 ☐ C About as easily.
☐ D A little less easily.
☐ E Less easily.

CONF

27. By the end of my first semester at the Academy I expect my grades will be:

- 0 ☐ A Good in some courses, low in others, with an overall average high enough to stay in school.
☐ B Average or better in every course.
1 ☐ C Very good in every course except possibly one.
☐ D Excellent in every course.

28. By the end of my first year at the Navy: I expect my military performance will

- ☐ A Good in some areas, low in others, with an high enough to stay in the service.
☐ B Average or better in every aspect
☐ C Very good in almost every aspect.
☐ D Excellent in every aspect.

29. In the past, how have you reacted to competition?

- ☐ A I have always done my best in competitive situations.
☐ B I have usually done my best in competitive situations.
☐ C I have done all right, but haven't liked it.
☐ D I have been unaffected by it.

LISTED BELOW ARE SOME OF THE TRADITIONAL ADVANTAGES OF A MILITARY CAREER AND A NAVAL ACADEMY EDUCATION. USING THE FOLLOWING SCALE, INDICATE HOW IMPORTANT EACH ITEM WAS IN YOUR DECISION TO CONSIDER A MILITARY CAREER.

		VERY UNIMPORTANT	RATHER UNIMPORTANT	IMPORTANT	VERY IMPORTANT	EXTREMELY IMPORTANT
MILIF	30. Opportunities to direct others, have responsibilities and authority.	A	B	C	D	E
	31. Disciplined life-style.	A	B	C	D	E
MONEY	32. Financial and tuition benefits.	A	B	C	D	E
	33. Promotion opportunities.	A	B	C	D	E
	34. Lack of adventure in civilian jobs.	A	B	C	D	E
	35. Economic security.	A	B	C	D	E
	36. Novelty of experience.	A	B	C	D	E

USING THE FOLLOWING SCALE, INDICATE HOW IMPORTANT IT IS TO YOU PERSONALLY, TO PURSUE EACH OF THE GOALS LISTED BELOW.

		VERY UNIMPORTANT	SOMEWHAT UNIMPORTANT	SOMEWHAT IMPORTANT	VERY IMPORTANT	EXTREMELY IMPORTANT
MILIF	37. An exciting life.	A	B	C	D	E
HWOR	38. A sense of accomplishment.	A	B	C	D	E
MILIF	39. Family security.	A	B	C	D	E
	40. Social recognition.	A	B	C	D	E
MONEY	41. Financial success.	A	B	C	D	E

42. In comparison with most of the people I know, I am able to give a talk before a group:

- ☐ A Much more easily.
☐ B Somewhat more easily.
☐ C Just as easily.
☐ D A little less easily.
☐ E Much less easily.

CONF

43. Compared to others my age, I think my athletic abilities are:

- ☐ A In the top 1%.
☐ B In the top 5%.
☐ C In the top 25%.
☐ D Average.
☐ E Below average.

CONF

44. Naval Academy students sometimes receiving their commission. If this should come to you, which of the following do you think would be the MOST LIKELY cause?

- ☐ A Not applicable, I am absolutely certain I will obtain a commission.
☐ B Change to a major not offered at the Naval Academy.
☐ C Lack of ability for military service.

CONF

- ☐ D Lack of academic ability or necessary study skills.
☐ E Other.

45. What kind of upbringing did you have? MILIF

- ☐ A Strict but fair.
☐ B Strict but unfair.
☐ C Inconsistent.
☐ D Not very strict but fair.
☐ E Not very strict but unfair.

46. When growing up, how often, compared to others your age, were you allowed to make your own decisions?

- ☐ A Much more often.
☐ B Somewhat more often.
☐ C About as often.
☐ D Somewhat less often.
☐ E Much less often.

47. How often do you help with chores and tasks around the home, the yard, or a family business?

- ☐ A Very often; I have jobs assigned to me and a regular schedule to do them.
☐ B Often, but not regularly.
☐ C Sometimes, when I am asked.
☐ D Sometimes; my parents complain a great deal but they rarely make me help.
☐ E Rarely or never; I am not required to.

TURN PAGE AND CONTINUE

48. I think of myself as a shy person:

- ☐ A Never.
- ☐ B Hardly ever.
- ☐ C Sometimes.
- ☐ D Often.
- ☒ E Almost always.

The following two questions must be answered in coordination. Please read all choices carefully before answering.

49. Which one of the following recreational activities do you engage in most often?

- ☐ A Participating in competitive team sports.
- ☐ B Participating in competitive individual sports.
- ☐ C Noncompetitive jogging, swimming, or other physical activity.
- ☐ D Social relaxation with others, such as parties, dances, etc.
- ☒ E None of the above. (CHOOSE A, B, C, or D in the NEXT QUESTION.)

50. Which one of the following recreational activities do you engage in most often? (ANSWER "E" IF YOU CHOSE A, B, C or D in the PREVIOUS QUESTION.)

- ☐ A Reading, listening to records or other solitary activities.
- ☐ B Attending or participating in plays, concerts, or other artistic activities.
- ☐ C Working on cars, bikes, models, or electronics.
- ☐ D Sailing, hiking, camping, or horseback riding.
- ☒ E None of the above; I chose A, B, C, or D in the previous question.

51. How often have you changed your mind about future career plans since you entered high school?

- ☐ A I have not changed my plans.
- ☐ B Only once.
- ☐ C Two or three times.
- ☒ D Four or more times.

52. When I had my first evening date my age was:

- ☐ A 13 or younger.
- ☐ B 14.
- ☐ C 15.
- ☐ D 16 or older.
- ☒ E I haven't had an evening date.

53. How well do you do most things you have decided to do?

HWORX

- ☐ A I almost always succeed in the things I attempt and do them better than most people do.

1 ☐ B I often find that I have bitten off more than I can chew and have to give up.

0 ☐ C I usually get the things done that I attempt, but I seldom do them as well as I want to.

☐ D I find that I do most things as well as other people do.

☐ E I seldom get the things done that I attempt, but I usually do them better than other people.

54. Which of the following is most typical of your study habits?

HWORX

1 ☐ A I work quite regularly.

☐ B I usually get to work when deadlines get close.

0 ☐ C I usually have to be in the mood.

☐ D I work quite irregularly.

55. In comparison with most of the people I know, I am able to make new friends:

CONF

1 ☐ A Much more easily.

☐ B A little more easily.

☐ C As easily as other people.

0 ☐ D A little less easily.

☐ E Less easily.

56. How many nonfiction magazines do you read each month?

- ☐ A None.
- ☐ B 1 or 2.
- ☐ C 3 or 4.
- ☐ D 5 or 6.
- ☐ E More than 6.

57. When faced with an unpleasant situation, I usually:

- ☐ A Try to react immediately and figure out the best solution.
- ☐ B Put it off for a little while so I can think it over.
- ☐ C Put it off for quite a while so I can think of a better solution.
- ☐ D Don't worry about it; things tend to take care of themselves.

58. During high school, I have been a leader in my group of friends:

- ☐ A Almost always.
- ☐ B Very often.
- ☐ C Often.
- ☐ D Sometimes, but not often.
- ☐ E Never.

HWORK

59. How hard do you usually work at getting good grades in high school?

- 1 ☐ A I work very hard.
☐ B I could work a little harder.
☐ C I could work a lot harder.
☐ D I don't have to work hard, I get good grades easily.

60. How many really close friends do you have?

- ☐ A I have a lot of them.
☐ B I have a few of them.
☐ C I have one really close friend.
☐ D I don't have any really close friends.

HWORK

61. I find myself putting things off until the last minute.

- ☐ A Almost always.
☐ B Often.
☐ C Sometimes, but not often.
☐ D Rarely.
☐ E Never.

MILIF

62. What is the highest level of formal education obtained by your mother or female guardian?

- ☐ A High school graduate or less.
☐ B Postsecondary school other than college.
☐ C Some college.
☐ D College degree.
☐ E Some graduate school or graduate degree.

63. What is the highest level of formal education obtained by your father or male guardian?

- ☐ A High school graduate or less.
☐ B Postsecondary school other than college.
☐ C Some college.
☐ D College degree.
☐ E Some graduate school or graduate degree.

HWORK

MILIF

MILIF

USING THE FOLLOWING SCALE, INDICATE THE EXTENT TO WHICH EACH OF THE STATEMENTS BELOW APPLIES TO YOU.

	VERY UNCHARACTERISTIC OF ME	SOMEWHAT UNCHARACTERISTIC OF ME	SLIGHTLY CHARACTERISTIC OF ME	SOMEWHAT CHARACTERISTIC OF ME	VERY CHARACTERISTIC OF ME
64. When I believe strongly in something, I act on it.	☐ A	☐ B	☐ C	☐ D	☐ E
65. I meet my obligations on time.	☐ A	☐ B	☐ C	☐ D	☐ E
66. I believe a person's day should be planned ahead each morning.	☐ A	☐ B	☐ C	☐ D	☐ E
67. I feel that people who can't meet deadlines just aren't organized enough.	☐ A	☐ B	☐ C	☐ D	☐ E
68. While I was growing up, I was encouraged to continue my education beyond high school.	☐ A	☐ B	☐ C	☐ D	☐ E
69. I believe that getting together with friends to "party" is one of life's important pleasures.	☐ A	☐ B	☐ C	☐ D	☐ E
70. Criticism makes me very uncomfortable.	☐ A	☐ B	☐ C	☐ D	☐ E
71. I think it's useless to plan too far ahead because things hardly ever come out the way you planned anyway.	☐ A	☐ B	☐ C	☐ D	☐ E
72. I complete projects on time by making steady progress.	☐ A	☐ B	☐ C	☐ D	☐ E
73. When an opportunity arises to have a good time, I take it and don't worry about the consequences.	☐ A	☐ B	☐ C	☐ D	☐ E
74. When I want to achieve something, I set subgoals and consider specific means for achieving those goals.	☐ A	☐ B	☐ C	☐ D	☐ E
75. It's hard for me to resist temptations.	☐ A	☐ B	☐ C	☐ D	☐ E
76. I take risks to put excitement in my life.	☐ A	☐ B	☐ C	☐ D	☐ E

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The following questions refer to the way in which certain important events in our society affect different people. Each item consists of a pair of alternatives lettered A or B. Please select the one statement of each pair (and only one) which you more strongly believe to be the case as far as you're concerned.

This is a measure of personal belief: Obviously there are no right or wrong answers. Try to respond to each item independently when making your choice; do not be influenced by your previous choices.

77. ☒ A Many of the unhappy things in people's lives are partly due to bad luck.

☐ B People's misfortunes result from the mistakes they make.

78. ☒ A In the long run, people get the respect they deserve in this world.

☐ B Unfortunately, an individual's worth often passes unrecognized no matter how hard he or she tries.

79. ☒ A Without the right breaks, one cannot be an effective leader.

☐ B Capable people who fail to become leaders have not taken advantage of their opportunities.

80. ☒ A Becoming a success is a matter of hard work; luck has little or nothing to do with it.

☐ B Getting a good job depends mainly on being in the right place at the right time.

81. ☒ A The average citizen can have an influence in government decisions.

☐ B This world is run by the few people in power, and there is not much the little guy can do about it.

82. ☒ A Most people don't realize the extent to which their lives are controlled by accidental happenings.

☐ B There is really no such thing as (good or bad) "luck".

83. ☒ A In the case of the well prepared student there is rarely, if ever, such a thing as an unfair test.

☐ B Many times, even questions tend to be so unrelated to course work that studying is really useless.

84. ☒ A It is hard to know whether or not a person really likes you.

☐ B How many friends you have depends on how nice a person you are.

85. ☒ A In the long run the bad things that happen to us are balanced by the good ones.

☐ B Most misfortunes are the result of lack of ability, ignorance, laziness, or all three.

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APPENDIX B IN-SAMPLE LOGISTIC REGRESSION RESULTS FOR THE CLASS OF 2000

This appendix provides the reader with the results of the Class of 2000 regressions. The regression and classification tables show the ability of the four-version model to predict attrition (in sample) for the Class of 2000. The classification tables then show the model's ability to predict graduates and non-graduates in a single class. The overall percent correct is also provided. When compared to the out-of-sample results in chapter 4, these results provide the reader the ability to evaluate the out-of-sample and in-sample predictive ability of the four-version model

Table A-1. Logistic Regression Results - Overall Attrition¹⁸

Overall Attrition - Class of 2000								
	Base Model		1st Variation Base Model + MBTI		2nd Variation Base Model + PHQ		3rd Variation Base+MBTI & PHQ	
	Coef	Sig	Coef	Sig	Coef	Sig	Coef	Sig
SATM_HI	-0.0005	0.7289	-0.0004	0.7734	-0.0007	0.6312	-0.0006	0.7178
SATV_HI	0.0035	0.0057	0.0030	0.0207	0.0035	0.0054	0.0031	0.0199
RSO_COMB	-0.0014	0.1531	-0.0015	0.1388	-0.0012	0.2143	-0.0014	0.1667
HS_OFFIC	-0.0022	0.0120	-0.0020	0.0224	-0.0023	0.0102	-0.0022	0.0193
MALE	-0.8238	0.0000	-0.9157	0.0000	-0.8322	0.0000	-0.9229	0.0000
HISPANIC	0.3607	0.1944	0.2667	0.3481	0.3541	0.2042	0.2602	0.3615
AFRICAN	0.2915	0.3537	0.1682	0.6048	0.1100	0.7339	0.0865	0.7955
ASIAN	0.0409	0.9135	0.0286	0.9414	0.0009	0.9980	-0.0024	0.9951
NATIVE	1.0990	0.1119	0.9162	0.2013	1.0873	0.1161	0.9210	0.2004
ESCORE	-	-	-0.0083	0.0111	-	-	-0.0078	0.0198
SSCORE	-	-	-0.0027	0.4080	-	-	-0.0028	0.3895
TSCORE	-	-	-0.0114	0.0015	-	-	-0.0114	0.0016
JSCORE	-	-	-0.0113	0.0003	-	-	-0.0108	0.0007
MONEY_GR	-	-	-	-	-0.0663	0.2650	-0.0509	0.4025
HWOR_K_GR	-	-	-	-	-0.0607	0.1871	-0.0345	0.4711
CONF_GR	-	-	-	-	0.0012	0.9876	0.0246	0.7618
MILIF_GR	-	-	-	-	-0.0859	0.2116	-0.0139	0.8448
Constant	-0.1631	0.8921	0.4368	0.7279	1.1782	0.3715	0.8557	0.5347

Table A-2. Overall Attrition Classification Table - Class of 2000¹⁹

	Grad	Attrite	Grad	Attrite	Grad	Attrite	Grad	Attrite
Grad	51.4%	-	50.7%	-	50.4%	-	50.4%	-
Attrite	-	11.6%	-	12.7%	-	11.9%	-	12.7%
Overall %Correct		63.0%		63.4%		62.3%		63.1%

¹⁸ Logistic regression results reflect in-sample results of the four-variation model for the Class of 2000.

¹⁹ The classification results represent the ability of each model to predict just for the Class of 2000.

Table A-3. Logistic Regression Results - Voluntary Attrition

Voluntary Attrition - Class of 2000								
	Base Model		1st Variation Base Model + MBTI		2nd Variation Base Model + PHQ		3rd Variation Base+MBTI & PHQ	
	Coef	Sig	Coef	Sig	Coef	Sig	Coef	Sig
SATM_HI	-0.0005	0.7838	-0.0003	0.8867	-0.0005	0.7706	-0.0002	0.9071
SATV_HI	0.0037	0.0119	0.0034	0.0261	0.0037	0.0115	0.0034	0.0265
RSO_COMB	-0.0005	0.6252	-0.0006	0.5989	-0.0004	0.7203	-0.0006	0.6226
HS_OFFIC	-0.0013	0.1777	-0.0012	0.2352	-0.0015	0.1498	-0.0013	0.1963
MALE	-1.0783	0.0000	-1.1954	0.0000	-1.0515	0.0000	-1.1736	0.0000
HISPANIC	0.2608	0.4248	0.1145	0.7318	0.2531	0.4399	0.1093	0.7444
AFRICAN	0.0626	0.8706	-0.0543	0.8914	-0.1291	0.7440	-0.1218	0.7653
ASIAN	-0.4589	0.3565	-0.5312	0.3001	-0.5173	0.3045	-0.5683	0.2708
NATIVE	1.0659	0.1604	0.7479	0.3477	1.0293	0.1824	0.7349	0.3617
ESCORE	-	-	-0.0093	0.0136	-	-	-0.0089	0.0196
SSCORE	-	-	-0.0008	0.8368	-	-	-0.0010	0.7957
TSCORE	-	-	-0.0152	0.0002	-	-	-0.0149	0.0003
JSCORE	-	-	-0.0120	0.0006	-	-	-0.0116	0.0015
MONEY_GR	-	-	-	-	-0.0608	0.3769	-0.0436	0.5346
HWOR_K_GR	-	-	-	-	-0.0232	0.6647	0.0067	0.9041
CONF_GR	-	-	-	-	-0.0458	0.6065	-0.0136	0.8832
MILIF_GR	-	-	-	-	-0.1394	0.0774	-0.0543	0.5083
Constant	-1.6429	0.2352	-1.2038	0.4050	-0.0583	0.9692	-0.6759	0.6694

Table A-4. Voluntary Attrition Classification Table - Class of 2000

	Grad	Attrite	Grad	Attrite	Grad	Attrite	Grad	Attrite
Grad	61.2%	-	55.6%	-	57.7%	-	56.1%	-
Voluntary Attrite	-	7.5%	-	11.7%	-	8.5%	-	10.5%
Overall % Correct		68.7%		66.3%		66.2%		66.6%

Table A-5. Logistic Regression Results - Academic Attrition

Academic Attrition - Class of 2000								
	Base Model		1st Variation Base Model + MBTI		2nd Variation Base Model + PHQ		3rd Variation Base+MBTI & PHQ	
	Coef	Sig	Coef	Sig	Coef	Sig	Coef	Sig
SATM_HI	-0.0010	0.7789	-0.0013	0.7125	-0.0018	0.6103	-0.0019	0.5830
SATV_HI	0.0057	0.0505	0.0058	0.0480	0.0057	0.0529	0.0060	0.0471
RSO_COMB	-0.0024	0.2311	-0.0027	0.1887	-0.0024	0.2274	-0.0026	0.1954
HS_OFFIC	-0.0100	0.0000	-0.0100	0.0000	-0.0095	0.0002	-0.0096	0.0001
MALE	0.1431	0.8054	0.1641	0.7823	-0.0008	0.9990	0.0572	0.9250
HISPANIC	0.7817	0.1471	0.7514	0.1659	0.8522	0.1159	0.8159	0.1364
AFRICAN	0.4745	0.4831	0.3706	0.5877	0.3307	0.6376	0.2490	0.7255
ASIAN	1.5648	0.0106	1.4977	0.0151	1.6622	0.0071	1.5785	0.0111
NATIVE	1.8328	0.1195	1.8298	0.1182	1.6938	0.1635	1.7427	0.1478
ESCORE	-	-	-0.0060	0.4368	-	-	-0.0048	0.5422
SSCORE	-	-	-0.0040	0.5901	-	-	-0.0034	0.6555
TSCORE	-	-	-0.0088	0.2948	-	-	-0.0105	0.2208
JSCORE	-	-	0.0030	0.6742	-	-	0.0040	0.5874
MONEY_GR	-	-	-	-	0.0187	0.8913	0.0185	0.8937
HWOR_K_GR	-	-	-	-	-0.1932	0.0591	-0.1990	0.0578
CONF_GR	-	-	-	-	0.1407	0.4246	0.1362	0.4424
MILIF_GR	-	-	-	-	0.1229	0.4481	0.1404	0.3977
Constant	0.8240	0.7640	1.3307	0.6342	0.9626	0.7503	1.2212	0.6972

Table A-6. Academic Attrition Classification Table - Class of 2000

	Grad	Attrite	Grad	Attrite	Grad	Attrite	Grad	Attrite
Grad	72.4%	-	71.6%	-	73.3%	-	73.1%	-
Academic Attrite	-	2.5%	-	2.5%	-	2.5%	-	2.4%
Overall % Correct		74.9%		74.1%		75.8%		75.5%

Table A-7. Logistic Regression Results - Performance/Conduct Attrition

Performance/Conduct Attrition - Class of 2000								
	Base Model		1st Variation Base Model + MBTI		2nd Variation Base Model + PHQ		3rd Variation Base+MBTI & PHQ	
	Coef	Sig	Coef	Sig	Coef	Sig	Coef	Sig
SATM_HI	0.0003	0.9366	0.0003	0.9444	0.0002	0.9679	0.0005	0.8948
SATV_HI	-0.0007	0.8250	-0.0025	0.4589	-0.0009	0.7928	-0.0028	0.4042
RSO_COMB	-0.0050	0.0365	-0.0043	0.0787	-0.0048	0.0458	-0.0042	0.0839
HS_OFFIC	0.0009	0.6917	0.0015	0.4866	0.0005	0.8385	0.0010	0.6698
MALE	0.3423	0.5934	0.0898	0.8930	0.3343	0.6102	0.0679	0.9203
HISPANIC	0.3282	0.6716	0.2562	0.7447	0.3675	0.6358	0.2714	0.7318
AFRICAN	1.0676	0.0891	0.9631	0.1406	0.7998	0.2230	0.8023	0.2347
ASIAN	-0.1465	0.8891	-0.0333	0.9750	-0.2507	0.8126	-0.1515	0.8876
NATIVE	-3.4607	0.8316	-4.2283	0.7876	-3.3695	0.8365	-4.1259	0.7930
ESCORE	-	-	-0.0033	0.6940	-	-	-0.0026	0.7584
SSCORE	-	-	-0.0122	0.1543	-	-	-0.0127	0.1482
TSCORE	-	-	0.0066	0.5001	-	-	0.0055	0.5742
JSCORE	-	-	-0.0225	0.0050	-	-	-0.0228	0.0069
MONEY_GR	-	-	-	-	-0.2379	0.1318	-0.2632	0.0952
HWORK_GR	-	-	-	-	-0.1322	0.2678	-0.0657	0.5950
CONF_GR	-	-	-	-	0.1009	0.6243	0.1371	0.5342
MILIF_GR	-	-	-	-	-0.0046	0.9790	0.0582	0.7424
Constant	0.2694	0.9316	0.5301	0.8711	1.6498	0.6236	0.8229	0.8178

Table A-8. Performance/Conduct Attrition Classification Table - Class of 2000

	Grad	Attrite	Grad	Attrite	Grad	Attrite	Grad	Attrite
Grad	80.2%	-	78.1%	-	77.9%	-	77.1%	-
Attrite	-	1.0%	-	1.7%	-	1.4%	-	1.5%
Overall % Correct		81.2%		79.8%		79.3%		78.6%

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LIST OF REFERENCES

- Black, L. (2001). Admissions Information System (AIS) User's Guide: A Manual Describing the U.S. Naval Academy's Admissions Process as Supported by the Admissions Information System (AIS). Annapolis: U.S. Naval Academy Information Technology Services Division.
- Bowman, W. (2001). An Analysis of the Career Retention Composite Used in the Candidate Multiple: Class of 1999. Paper prepared for a class with the LEAD Program of the Naval Postgraduate School. Paper can be obtained by contacting foster@usna.edu.
- Briggs-Myers, I. (1998). MBTI Manual: A Guide to the Development and Use of the Myers-Briggs Type Indicator. Palo Alto: Consulting Psychologists Press.
- Inscape Publishing. (1996). A Comparison of the Personal Profile System and the Myers-Briggs Type Indicator. (Report O-231). Minneapolis: Inscape Publishing
- Conoley, J. & Impara, J. (1994). The Supplement to the Eleventh Mental Measurements Yearbook. Lincoln: The University of Nebraska Press.
- Donnay, D. & Borgen. (1996). Validity, structure, and content of the 1994 Strong Interest Inventory. Journal of Counseling Psychology, 43, 275-291.
- Hammer, A., & Mitchell, W. (1996). The distribution of MBTI types in the US by gender and ethnic group. Journal of Psychological Type, 37, 2-15.
- Larson, C (1995). Class Standing and Merit Lists. (USNA Instruction 1531.51A). Annapolis: United States Naval Academy.
- McNitt, RADM, USN (Ret.) R. W., Dean of Admission, U.S. Naval Academy to Manley, Subject: Strong Campbell Interest Inventory, 17 September 1982.
- O'Connor, J. (1993). Use of the MBTI as a Predictor of Successful Academic and Military Performance at the United States Coast Guard Academy (Report 10-93). New London: Center for Advanced Studies, United States Coast Guard Academy.

- Page, E.C. (1983). Looking at Type: A description of the preferences reported by the Myers-Briggs Type Indicator. Gainesville: Center for Applications of Psychological Type.
- Pascarella, E. T., Terenzini, P. T., & Wolfle, L. M. (1986). Orientation to college and freshman year persistence/withdrawal decisions. Journal of Higher Education, 57(2), 155-175.
- Rosati, P. (1997). Students' Psychological Type and Success in Different Engineering Programs. Retrieved March 21, 2002 from the World Wide Web:
<http://www.fie.engr.pitt.edu/fie97/papers/1005.pdf>
- Roush, P. (1989). MBTI type and voluntary attrition at the United States Naval Academy. Journal of Psychological Type, 18, 72-79.
- Sheppard, T. (2001). A Validation of the Strong Interest Inventory as Part of the Admissions Process at the United States Naval Academy. Masters Thesis. Monterey: Naval Postgraduate School.
- Thorne, A., & Gough, H. (1991). Portraits of Type: An MBTI Research Compendium. Palo Alto: Consulting Psychologists Press.
- Tinto, V. (1993). Leaving College: Rethinking the Causes and Cures of Student Attrition. Chicago: The University of Chicago Press.
- United States Naval Academy 2000-2001 Catalog. (2000). Annapolis: U.S. Naval Academy Public Affairs Office.

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