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TAILORED ADAPTIVE PERSONALITY ASSESSMENT SYSTEM (TAPAS) EXAM ABILITY TO PREDICT PROFICIENCY AND PERFORMANCE AMONG NAVAL ACADEMY PRODUCED MARINE CORPS OFFICERS

Newman, James C., Jr.; Compton, Monica L.

Monterey, CA; Naval Postgraduate School

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THESIS

TAILORED ADAPTIVE PERSONALITY ASSESSMENT SYSTEM (TAPAS) EXAM ABILITY TO PREDICT PROFICIENCY AND PERFORMANCE AMONG NAVAL ACADEMY PRODUCED MARINE CORPS OFFICERS

by

James C. Newman Jr. and Monica L. Compton

June 2022

Thesis Advisor:	Chad W. Seagren
Co-Advisor:	Kevin Mullaney, USNA

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13. ABSTRACT (maximum 200 words)

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We found that adding TAPAS to data that the Marine Detachment (MarDet) considers for the selection process is likely to provide only a meager improvement. However, there are several TAPAS facets, such as optimism and academic achievement, that are positively correlated to performance at TBS, as well as sociability, which is negatively correlated to performance at TBS. Furthermore, combining the TAPAS data with existing selection metrics for the MarDet, we see an impact in the ranking positions for USNA-produced officers at TBS. While the data is significant, we recommend further studies to determine the full extent that TAPAS supports predicting performance for officers at TBS and potentially the success of Fleet Marine Force.

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EXAM ABILITY TO PREDICT PROFICIENCY AND PERFORMANCE
AMONG NAVAL ACADEMY PRODUCED MARINE CORPS OFFICERS**

James C. Newman, Jr.
Captain, United States Marine Corps
BA, Rutgers, State University of New Jersey, 2017

Monica L. Compton
Captain, United States Marine Corps
BS, Taylor University, 2016

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Approved by: Chad W. Seagren
Advisor

Kevin Mullaney
Co-Advisor

Nicholas Dew
Academic Associate, Department of Defense Management

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LIST OF ACRONYMS AND ABBREVIATIONS

AFQT	Armed Forces Qualification Test
ANOVA	Analysis of Variance
AOM	Academic Order of Merit
ASVAB	Armed Services Vocational Aptitude Battery
DC, M&RA	Deputy Commandant, Manpower and Reserve Affairs
FMF	Fleet Marine Force
ITR	Item Response Theory
M&RA	Manpower and Reserve Affairs
MarDet	Marine Detachment, USNA
MaRSATS	Marine Recruiting and Service Assignment Tracking System
MEPS	Military Entrance Processing Stations
MOM	Military Order of Merit
MOS	Military Occupational Specialty
NROTC	Naval Reserve Officer Training Corps
OBEF	Officer Background and Experience Form
OCS	Officer Candidate School
OOM	Overall Order of Merit
SPC	Staff Platoon Commander
TAPAS	Tailored Adaptive Personality Assessment System
TBS	The Basic School
USNA	United States Naval Academy

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I. INTRODUCTION

The Marine Corps currently has three accession routes for officers entering the service: Officer Candidate School (OCS), Naval Reserve Officer Training Corps (NROTC), and the United States Naval Academy (USNA). The Basic School (TBS) is the follow-on school for all new officers regardless of their method of entry into the Marine Corps. TBS is approximately six months long, teaching the new officers the basics of professionalism and leadership, as well as the basic skills of a rifle platoon commander. Upon completion of TBS, the officers will continue on to their military occupational specialty (MOS) training. The length of the MOS training varies. For example, the course length of the Basic Manpower Officer Course lasts 48 training days, while the flight school pipeline for pilots can last 1 to 2 years. Finally, upon completion of MOS training, most officers enter the Fleet Marine Force (FMF).

Starting when the Marine Corps recruits individuals for each accession route to those individuals finally hitting the FMF, there is a substantial amount of time and money invested in each individual. TBS alone is a significant monetary and time investment in each officer who enters the Marine Corps. Following TBS, each MOS school puts additional time training each officer to work in and lead Marines in a given field. When officers separate from the Marine Corps, these costs can no longer be recovered in the form of personnel productivity, and that investment has been lost. There are also cases where the Marine Corps invests in training an individual in one MOS, and then after one tour, they conduct a lateral transfer into a different MOS that better suits their preferences and abilities. When individuals conduct a lateral transfer, this creates added time and money the Marine Corps invests in those individuals that could have been avoided through a better model of assigning an MOS. In order to save money and maximize its investment in trained officers, the Marine Corps is looking to find ways to improve its ability to predict attrition and performance. One possible method to bring improvement in this process is to include non-cognitive measures in current performance prediction models.

The Tailored Adaptive Personality Assessment System (TAPAS) is a non-cognitive measure derived from state-of-the-art personality research and has its roots in the Big Five

Theory of Personality (Drasgow et al., 2012). Since 2018, TAPAS has been administered to Marine Officer candidates at the USNA. This provides the opportunity to study non-cognitive measures and Marine Officer accession from the Naval Academy, to include their performance at TBS.

The Marine Detachment (MarDet) at USNA selects approximately 25 percent of a graduating class to be Marine Officers once they graduate. For example, the MarDet selected 279 members of the Class of 2022 to commission as Second Lieutenants. They use several factors in determining if a Midshipman will be selected to be a Marine. Some of the quantitative factors include grade point average, overall class standing, and performance on various training evolutions including a summer training known as Leatherneck, which is a requirement to be considered for a Marine Corps selection. To ensure success at TBS and in the FMF, it is important that the MarDet selects the most qualified candidates to commission as Marine Corps Officers. The purpose of this study is to compare individuals' scores of TAPAS facets with the final TBS rankings for USNA-produced officers to investigate if there is an association between those variables. More specifically, we examine if adding TAPAS facets to the data currently used in the Marine Corps selection process used at the USNA improves the process.

Our approach to this fulfills this purpose is two-fold. The first is managerial. This idea focuses on investigating whether or not TAPAS is an effective addition to the current Marine Officer selection process that exists at USNA. The second is psychological. That is, we examine which USNA-produced Marine Officers are successful at TBS based on individual non-cognitive facets.

We found that adding TAPAS to the data the MarDet already considers for the selection process is likely to provide only a meager improvement. However, there were several TAPAS facets, such as optimism and academic achievement that are positively correlated to performance at TBS, and sociability, which is negatively correlated to performance at TBS. Furthermore, by combining the TAPAS data with the existing selection metrics for the MARDET, we did see an impact in the ranking positions for USNA-produced officers at TBS. Specifically, the combined metrics, TAPAS and MARDET, showed that officers with higher optimism, achievement, and courage thetas

saw roughly a 13, 11, and 12 spot increase in their overall ranking at TBS respectively. Conversely, those officers with a higher sociability theta could expect their overall ranking to decrease by about nine spots. While the data was significant, we recommend further studies to determine the full extent that TAPAS supports predicting performance for officers at TBS and potentially FMF success.

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II.   LITERATURE REVIEW

A significant amount of literature, essays, and other publications exist regarding TAPAS results and their relationship to performance. Despite the research and literature that exists, there is minimal research that references TAPAS results and performance with relation to military officers, and more specifically, Marine Corps Officers. A review of the available literature does indicate that TAPAS testing has been able to predict, to an extent, success or failure regarding MOS placement (Nye, 2012), re-enlistments (Hughes, 2020), delayed entry program attrition (Turpin, 2014), and other similar factors.

Given these studies, we seek to determine if the same conclusions can be drawn for Marine Corps Officers who graduate from the United States Naval Academy. We have evaluated both TAPAS specific research as well as research related more broadly to the Big Five personality traits and how those factors into success or failure during military training and similar endeavors.

A.   BIG FIVE THEORY OF PERSONALITY

Personality has been studied for many centuries, with the theory of personality types emerging with Hippocrates' four humors model. He had identified the choleric, the melancholic, the sanguine, and the phlegmatic as the four basic temperaments that corresponded to excess in the four body fluids of yellow bile, black bile, blood, and phlegm (Millon, 2012). The four humors model has long since been disproved, and many other models and theories of personality have emerged. One of these theories that has emerged as a major contributor to personality theory is the Five-Factor Model of personality, also referred to as the Big Five theory of personality.

The Big Five Theory of Personality emerged from trait theory. Trait theory takes the approach that there are trends in a person's behaviors that will be relatively consistent over time and across situations. The trait theory began to emerge with Gordon Allport and H. S. Odbert (1936) when he created a catalog of terms that consisted of 4,500 terms that he labeled as stable traits. A historical review of the Big Five by Digman (1990) shows that work by Raymond Cattell (1947) began to refine this list of traits, along with work by

Donald Fiske (1949). In a study conducted by the Air Force, Tupes and Christal (1961) used the work by Cattell and Fiske to identify five factors that emerged as they studied personality traits. These factors were Surgency, Agreeableness, Dependability, Emotional Stability, and Culture.

Since then, there has been a significant amount of research conducted examining traits and personality, and eventually, the Big Five Theory began to emerge as commonalities between research were identified (Digman, 1990; Goldberg, 1990). As studies were evaluated, a consensus was reached that the factors that comprised the Big Five theory are Openness, Conscientiousness, Extraversion, Agreeableness, and Emotional Stability (also referred to as Neuroticism) (Drasgow et al., 2012). The Big Five does not imply that personality is made up of only five traits, rather these five traits provide a useful way to broadly categorize individual differences in people. Openness is also referred to as openness to experience, and is defined by John and Srivastava (1999, pp. 121) as "the breadth, depth, originality, and complexity of the person's mental and experiential life." Conscientiousness is defined as "socially prescribed impulse control that facilitates task- and goal-directed behavior" (John and Srivastava, 1999, pp. 121). Extraversion describes an "energetic approach toward the social and material world" (John & Srivastava, 1999, pp. 121). Agreeableness refers to a "prosocial and communal orientation toward others with antagonism and hostility" being behaviors on the low end of the scale (John and Srivastava, 1999, pp. 121). Finally, neuroticism refers to the contrast of "negative emotionality with emotional stability, contentment, and frustration tolerance" (John and Srivastava, 1999, pp. 121). While there is agreement on these five main factors of the model, there is less consensus on the facets that comprise each of the five factors.

Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism are referred to as the broad (or global) factors, and each of those factors is comprised of facets that are often referred to as lower-order traits. As the Big Five emerged, different inventories and instruments have emerged as researchers attempt to find the best way to measure the broad factors. While these different inventories and instruments all attempt to measure the broad factors, the names and number of facets they use to measure each factor differs. For example, the Neuroticism, Extraversion, and Openness Personality Inventory-

Revised (NEO-PI-R), as devised by Costa and McCrae in 1992, measures each factor of the Big Five using six facets per trait. While the newer Big Five Inventory-2 (BFI-2), as devised by Soto and John (2017), measures each factor using three facets per trait. When comparing the two there are some similarities in the defined facets, but there are also differences. For example, NEO-PI-R measures Conscientiousness using the facets of competence, order, dutifulness, achievement striving, self-discipline, and deliberation, while BFI-2 measures Conscientiousness using the facets of organization, productiveness, and responsibility (Costa and McCrae, 1992; Soto and John, 2017).

This is just one of the numerous examples of how there is no agreed-on taxonomy for the facets of the Big Five. In a report by Drasgow et al. (2012), they attribute these differences to the observation that some of the taxonomies are based on either "unverified theoretical assumptions, rational judgments, or researchers' own intuitions about the lower-order structure of a specific Big Five factor" (pp.15). As Drasgow et al. worked to develop the TAPAS instrument they wanted the trait taxonomy to be empirically based and to reduce redundancy seen in other measures, so they conducted factor analytic studies (2012). Through their empirical approach, they identified 22 facets that could be located within the Big Five, with each trait consisting of 3 to 6 facets (Drasgow et al., 2012).

The Big Five also began to emerge as a useful tool in personality research because it was shown to generalize across cultures, remain consistent over time, and was shown to potentially have a genetic basis (Judge et al., 1999). In an examination of the development of the Big Five taxonomy across cultures, there was difficulty in replicating the structure due to cross-lingual differences between certain cultures. Despite this, there is no evidence that shows different cultures and languages have unique personality dimensions when it comes to the broad traits (John, 2021). Although a study by Donellan and Lucas (2008) suggested that Extraversion and Openness tend to decrease as individuals get older, while agreeableness tends to increase with age. Other conflicting studies show minimal differences for Extraversion and Openness across ages (Soto et al., 2011), or positive and negative associations for extraversion and age depending on the gender (Srivastava et al., 2003).

B.   BIG FIVE AS A PREDICTOR

With the emergence of the Big Five, it became a common tool to use when studying behavior and performance with the assumption that personality traits would influence how people interact in different environments or situations. Barrick and Mount (1991) conducted a study that examined the relationship of the Big Five to job performance across several different occupational groups. Their measures of job performance included job proficiency, training proficiency, and personnel data. The occupational groups they studied included professionals, police, managers, sales, and those who were categorized as skilled or semi-skilled. Conscientiousness was shown to have consistent relations with all job performance criteria for all occupational groups, specifically, individuals high in the facets of sense of purpose, obligation, and persistence generally performed better than those who are lower (Barrick and Mount, 1999). Barrick and Mount (1999) also found that extraversion was a valid predictor for all job performance criteria for the occupational groups of managers and sales. A study by Judge et al. (1999) used the Big Five to show that adulthood measures of traits were related to career success while controlling for general mental ability. Specifically, they found that "high conscientiousness was associated with intrinsic career success, while low neuroticism, low agreeableness, high extraversion, high conscientiousness, and high cognitive ability were associated with extrinsic career success" (Judge et al. 1999, pp. 643).

When it comes to general job performance, Neuroticism has also been shown to be an important predictor when it comes to job satisfaction. In a study by Thoresen et al. (2003), they examined how Neuroticism correlated to job attitudes including job satisfaction, organizational commitment, emotional exhaustion, depersonalization, personal accomplishment, and turnover intentions. They found that those who scored higher in neuroticism were more likely to experience emotional exhaustion and burnout, as well as higher levels of job turnover. While those who scored lower in neuroticism were more likely to have higher levels of job satisfaction and organizational commitment (Thoresen et al., 2003).

In a more recent study, Judge and Zapata (2015) examined how situation strength and trait activation would affect the validity of using the Big Five traits to predict job

performance. One of the results was that each of the Big Five traits were more predictive of performance in jobs where the work was done in weak situations, that is situations with less structure and more ambiguity. They also found that many traits could predict job performance when looking at how the job context would activate specific traits. For example, with jobs that favor innovation and creativity, they found that openness was a more active trait which resulted in a stronger ability to predict job performance. The idea that the Big Five is more predictive of performance in weak situations is important when considering the use of personality theory to predict performance in the military because combat and the fog of war will place military members in many weak situations.

There have been several studies that use the Big Five when examining military performance. A study by Bartone et al. (2009) evaluated the influence of hardiness, social judgment, and the Big Five on leader performance for cadets at West Point during summer training and academic periods. Doing multivariate analyses, they found that depending on the context only the factors of extraversion and conscientiousness could predict leader performance. Specifically, extraversion was the only "significant independent predictor of leader performance during summer training" and conscientiousness was "a significant predictor of leader performance during the academic year" (Bartone et al., 2009, pp. 508, 511). A study of military academies in Norway showed similar results with consciousness showing a relationship to both military and academic performance, with the facet of self-efficacy appearing as "a partial mediator between conscientiousness and performance" (Fosse et al., 2016, pp. 1). Conscientiousness as a predictor of academic performance at the college level is also consistent outside of the military context, with conscientiousness being shown as a predictor of higher academic grade-point averages (George et al., 2001; Goldberg et al., 1998).

Jaunal (2017) used the Grit Scale and Big Five to identify non-cognitive traits that lead to successfully completing the Marine Corps Scout Sniper Course. He found that the traits of grit, extroversion, conscientiousness, and neuroticism displayed a level of statistical significance for those who graduated (Jaunal, 2017). Specifically, those that scored higher in extroversion, conscientiousness, and neuroticism had a lower probability

of graduation. Jaunal attributed that result to the team efficiency, emotional stability, and innovation required to succeed as a scout sniper (2017).

C. CRITICISM OF USING PERSONALITY TESTS FOR PREDICTING PERFORMANCE

As the popularity and acceptance of the Big Five has increased, along with its use in personnel selection, some have voiced concerns about using personality tests in this context. A common criticism of personality testing for personnel selection is the potential for response bias due to using self-report measures. Specifically, respondents faking their responses toward what they perceive to be the more socially desirable answer or the more desirable answer for the job or position they are seeking. There has been conflicting research on whether the presence of faking affects the validity of personality testing. For example, Ellingson, Smith, and Sackett (2001), found that respondents answering in a socially desirable manner did not influence the construct validity of several tests that were based on the Big Five. While Christiansen et al. agrees that the construct validity is minimally affected, he points out that hiring decisions can be affected if the results with faked answers are being used in the selection decisions (1994).

Morgeson et al. in 2007, published a couple of articles criticizing the use of personality tests for personnel selection and exploring some of the limitations of these types of tests. Their first article is a report on a panel discussion that took place at a conference of the Society for Industrial and Organizational Psychology, in which the current literature on the use of personality tests in personnel selection was discussed (Morgeson et al. 2007a). They had several conclusions that came out of the panel discussion based on the agreement between panelists. They believe analysis of the literature shows that "faking on self-report personality tests should be expected, and it probably cannot be avoided, although there is some agreement among authors on the extent to which faking is problematic" (Morgeson et al., 2007b, pp. 720).

They also argue that when it comes to predicting overall job performance, personality tests have low validity and that the studies that show the highest reported validity are inflated because of methodological weaknesses (Morgeson et al., 2007b). They

argue because of this low validity and since many of the personality tests are self-report, they should not be used for personnel selection, and if they are used, they should be used in conjunction with other cognitive ability tests. They do acknowledge personality theories do have value when it comes to understanding job behaviors and they encourage future research to find alternate methods to self-report measures.

Understanding that the quality of measurement and resistance to faking are important in developing a system to be used in personnel selection, the developers of TAPAS looked to take an alternative approach. Historically, personality tests have taken a dichotomous approach, using agree or disagree options, or a polytomous approach using formats like the Likert scale. In high stakes testing situations those approaches are more easily faked because it is easier for test-takers to guess what the socially desirable answer would be for the context they are taking the test (White et al., 2008). Drasgow et al. (2012) believe that using the item response theory (IRT) approach and multidimensional pairwise preference items is a promising alternative that minimizes an individual's ability to fake and ultimately increases the validity of the results for personnel selection.

D.   TAPAS FOCUSED RESEARCH

Turpin (2014) evaluated TAPAS to predict accession from the DEP by new recruits to their initial attempt at Navy recruit training. The study evaluates both the relationship-p between TAPAS composite scores and DEP attrition as well as the individual facet scores and DEP attrition. The "can-do" portion of the TAPAS was found to be a moderate predictor of accession from the DEP to initial recruit training. The data referenced in the study stated that "an additional point of the can-do composite score decreased the possibility of accession by .03 percentage points" (pp. 21, Turpin, 2014). On the other hand, the "will-do" portion had no significance on attrition from the DEP.

Of the TAPAS facets, the most significant were dominance, intelligence efficiency, and order (Turpin, 2014). Commitment to serve as a facet that was added to the TAPAS test specifically for the armed forces also proved to be a predictor of accession from the DEP to recruit training (Turpin, 2014). Of all the facets, dominance was the single largest predictor of DEP attrition (Turpin, 2014).

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Drasgow et al. (2012) also used TAPAS to evaluate can-do and will-do criteria as well as attrition in the U.S. Army. Similarly, to Turpin (2014) this study found that TAPAS was a predictor of behavior based on ca-do and will-do criteria. However, Drasgow et al. (2012) also found that will-do criteria also played a role in predicting the success and behavior of enlisted personnel. For their study, Drasgow et al. (2012) evaluated the relationship between TAPAS and the four largest MOS field in the Army; Infantry, Combat Medic, Military Police, and Motor Transport Operators. The results indicated that TAPAS composite scores had relationships with outcomes such as disciplinary incidents, attrition, and job knowledge. The study also found that each MOS required different composite scores to be used to predict performance. According to Drasgow et al. (2012), since different composites were required for different MOS fields, TAPAS may be useful for MOS classifications. The results from this study stated that Army personnel who performed poorly in one MOS field could have performed significantly better in another MOS (Drasgow et al. 2012).

In a separate study, Drasgow et al. (2012) assessed the need for a personality test like TAPAS to support U.S. Army personnel selection into the service. Tests such as the Armed Services Vocational Aptitude Battery (ASVAB) test are already administered at the Military Entrance Processing Stations (MEPS) across the country. Both TAPAS and the ASVAB are effective at explaining the can-do criteria when it comes to entrance in the Army. However, the ASVAB exam is not effective in explaining the will-do criteria of factors such as physical fitness and attrition. TAPAS, on the other hand, was effective at explaining the will-do criteria further validating its use as a military entrance tool for the Army and potentially other services (Drasgow et al. 2012). Additionally, the need for testing that is "fake-resistant" was identified since single statement personality tests have proved to be easily faked by test takers. The TAPAS test uses a multi-dimensional forced choice approach that is more resistant to faking, thus providing the service with more accurate results from test takers (Drasgow et al., 2012).

Niebuhr et al. (2013) also evaluated TAPAS as a pre-accession screener for early attrition and added the realm of mental health disorders to their study. Like much of the other research, this study evaluates U.S. Army recruits. This study attempts to demonstrate

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the use of noncognitive personality tests to predict mental disorder diagnosis and/or attrition from the Army within the first six months of service.

Niebur et al. (2013) found that TAPAS was successful at predicting attritions and the use of mental health and general health facilities. According to the results of this study, TAPAS scorers in the lowest quintile had the highest rate of attrition (Niebur et al., 2013). Additionally, those same individuals had increased odds for a general medical diagnosis and mental disorder diagnosis. Individuals in the lowest quintile of the physical dimension also had increased use of general medical as well as mental health care (Niebuhr et al., 2013). Niebuhr et al. (2013) concluded that noncognitive personality tests like TAPAS could potentially be used as possible alternatives for other screening tools for mental health fitness for future U.S. military recruits. The authors of this study did acknowledge that further analysis is needed of TAPAS to examine longer periods of follow-up as well as possible uses in other branches of service.

Riley (2017) further builds on the desire to determine if noncognitive personality tests like TAPAS can be used to build teams that are more effective in the workplace. Riley uses a case study approach to demonstrate the need for the right personnel to be on a team to ensure success. One of the case studies evaluates the selection process for SEAL training. Riley acknowledges that the SEAL selection process is already an efficient one, however, errors still exist. Riley references type one and type two errors. Type one errors occur when someone who would be a good fit for a job is cut from the job and a type two error occurs when someone who is not a good fit for a job passes the training required for the job and is retained. Tests like TAPAS can further help to ensure that the right types of people are selected for the right job. For the SEAL example, specifically, TAPAS could possibly help to reduce the attrition rate by identifying people who are likely to quit training and attrite from the course.

Nye et al. (2104) also conducted a study in relation to TAPAS and special operations selection. Since there has already been a lot of research indicating that TAPAS has been able to predict proficiency in the regular Army, this additional study focused on Army special operations assessment and selection. Like previous data indicated in other research, soldiers who scored in the highest quintile for TAPAS were significantly more

likely to be selected for Army Special Operations than those who scored in the lowest quintile.

Kirkendall et al. (2020) sought to validate TAPAS for predicting in-unit performance by U.S. Army soldiers. This more recent study that took into account soldiers who were already in the service found that the will-do composite demonstrated the highest utility for predicting in-unit performance. Conversely, the can-do composite of TAPAS did not improve the model's ability to improve performance and only slightly increased validity when it came to predicting attrition. This is contrary to Turpin's (2014) study. As previously stated, Turpin found that the can-do composite had more validity in predicting performance. It is worth noting that Turpin was specifically evaluating attrition and Kirkendall et al. (2020) also states that the can-do composite had incremental validity in predicting attrition.

This study provided valuable information about someone's potential success as a soldier. The study indicated that this data was not captured anywhere else in the accession process for recruits entering the Army. This study is in line with other research indicating that personality is a good predictor of the various outcomes evaluated and the methodology of TAPAS is better for the selection process since its forced choice questions seem to be generally resistant to faking.

Hughes et al. (2020) also used attrition to study TAPAS and added the element of reenlistment to their research. U.S. Army Soldiers were evaluated from the time of accession into the Army. They were observed at the 12-month point, which is typically when entry level training is complete, and then again at the 36-month point, which is when reenlistment is an option. Hughes et al. took data from TAPAS as well as the Armed Forces Qualification Test (AFQT). The results of their study were like previous studies about performance and attrition with relation to TAPAS. For entry level soldiers within their first 12 months of service, those who placed a greater emphasis on physical conditioning on their TAPAS were less likely to attrite (Hushes et al., 2020). This correlation was the opposite for soldiers who completed their first enlistment. For AFQT scores, soldiers who scored higher were less likely to reenlist in the Army following their initial enlistment. Overall, however, it was difficult to evaluate reenlistment since it is tied to specific MOS

needs for the service. Since many MOS's would have small sample sizes, there would not be enough data to draw a significant conclusion from.

For the purposes of our study, research involving retention is not necessarily significant since the focus of our study is to evaluate a correlation between TAPAS and success at TBS for Marine Officers. The portion of the study from Hughes et al. (2020) with relation to performance and early attrition will help to further our study with relation to Naval Academy graduates.

Trent et al. (2020) went somewhat deeper into the TAPAS from a faking score inflation standpoint. In their study, Trent et al. indicated that personality measures have been useful predictors of job performance for similar past studies and they wanted to further that research by understanding if a personality test like TAPAS could be used to predict counterproductive workplace behavior. In this case, the TAPAS test was administered via computer to U.S. Air Force applicants at a MEPS facility. While many applicants were told to take the test and answer all the questions truthfully, some applicants were told to try to fake the test to improve their individual facet scores. Since previous studies have shown that forced choice personality tests like TAPAS are more resistant to score inflation due to faking than on other types of tests, this study sought to further validate that information. The results of the scores from the applicants showed that under honest and directed fake-good conditions, there were not significant or noteworthy score fluctuations across either condition. These results were in keeping with previous studies and show that TAPAS is relatively resistant to faking. Given these results, a test like TAPAS given to future Marine Corps Officers has an even greater potential to place the right people in the right positions since it is difficult to fake answers to achieve a higher score on the several facets that are tested.

Allen et al. (2014) assessed TAPAS among other tests as a predictor of performance when selecting soldiers and civilians to attend the U.S. Army OCS. This is one of only a few studies that observe the correlation between officers or potential officers with relation to TAPAS. For this study, potential candidates fill out the Officer Background and Experience Form (OBEF) which is a series of batteries to include the TAPAS test. The study indicated that TAPAS was a top two OBEF instrument for predicting "key

performance and continuance outcomes of interest (Allen et al., 2014)." Specifically, TAPAS predicted performance in peer leadership rating, APFT, commitment, and career intentions among others. Allen and the rest of the authors acknowledge that their study does not account for the potential for faking or coaching, however previous research indicates that the forced choice format of TAPAS makes it somewhat resistant to faking or coaching. Since our study is focused on assessing officers, having a similar study that also assesses the potential success of future officers, albeit in another service, during entry level training will be valuable as we assess the data we have collected.

E.   SUMMARY

A significant amount of research already exists regarding TAPAS and the test's relationship to performance in the military. Much of the research and data available demonstrates that TAPAS is, at a minimum, successful at predicting success and performance for entry level enlisted personnel. Specifically, physical fitness metrics have directly correlated to those who place a greater emphasis on physical conditioning on the TAPAS test. For the purposes of our study, this information is extremely relevant. A significant amount of data is collected on Midshipmen during their time at the Naval Academy. All this data is used to assign each Midshipman to a service. The current Midshipmen who desire to become Marines take the TAPAS test while attending the Leatherneck training event the summer prior to their senior year. Once a Midshipman is selected as a Marine, they will inevitably attend TBS. This entry level training as well as the TAPAS score will help to identify if there is a correlation between TAPAS performance and where a Second Lieutenant finishes in their class standing at TBS. If the previous research on TAPAS in relationship to entry level enlisted training is an indicator, we will potentially see a positive correlation between elements of TAPAS and performance at TBS.

III.   METHODS

This chapter describes the variables studied and the research approach taken to analyze the data. It specifically describes the independent and dependent variables used in the correlation tables, the regression analysis, and additional statistical analysis.

A.   INDEPENDENT VARIABLES

1.   TAPAS Facets

The main independent variables for this study include the individual TAPAS facets. TAPAS measures the Big Five Factors through various facets. The original TAPAS assessment contains 22 facets, but the version of TAPAS administered at Leatherneck is modified to now include 18 facets. This modified version emerged through testing and administering TAPAS at MEPS (Drasgrow et al., 2012). It contains 15 facets from the original assessment and 3 additional facets that are more military-specific to help enhance the assessment in selecting individuals for a military population. The three facets that are now included are categorized as outside of the Big Five Factors. We describe and identify each facet below in Table 1. In addition, the summary statistics for TAPAS thetas can be found in Table 2.

Since 2018, all attendees of the USNA Leatherneck summer training program have been offered the opportunity to take TAPAS. At the beginning of the training evolution, all Leatherneck participants are invited by the research team to participate in the TAPAS survey and the research. At the conclusion of the informational introduction, participants are given the opportunity to read the consent form and participate in the study. Nearly all who are eligible chose to participate in the study.

Under contract from the Army Research Institute (ARI), the Drasgow Consulting Group (DCG) developed a version of TAPAS to be administered to Marine Officer participants. That version consists of TAPAS items, item selection algorithms, scoring algorithms, and data capturing procedures for item responses, response latencies, computed fact scores, computed composite scores, and computed response integrity indices. For this study a version of TAPAS is administered to the Leatherneck participants via paper and

pencil at the beginning of Leatherneck training in Quantico, Virginia. Once completed, the tests are transported to ARI and DCG for scoring. Once the scoring was complete the results are returned to Deputy Commandant, Manpower and Reserve Affairs (DC M&RA), who provides the scores to the researchers of this study.

Table 1.   Facet taxonomy for TAPAS: Trait names, markers, and descriptions. Source: Drasgow et al. (2012).

Big Five Factor	TAPAS Facet	Key Adjectives	Brief Description
Extraversion	Dominance	assertive, direct, submissive, helpless	High-scoring individuals are domineering, "take charge" and are often referred to by their peers as "natural leaders."
	Sociability	sociable, gregarious, talkative	High-scoring individuals tend to seek out and initiate social interactions.
	Physical Conditioning	active, vigorous, fit, inactive, brisk	High-scoring individuals tend to engage in activities to maintain their physical fitness and are more likely to participate in vigorous sports or exercise.
Agreeableness	Selflessness	charitable, helpful, generous, stingy, selfish	High-scoring individuals are generous with their time and resources.
Conscientiousness	Achievement	ambitious, industrious, aimless	High-scoring individuals are seen as hard-working, ambitious, confident, and resourceful.
	Order	organized, neat, sloppy	High-scoring individuals tend to organize tasks and activities and desire to maintain neat and clean surroundings.

Big Five Factor	TAPAS Facet	Key Adjectives	Brief Description
	Responsibility	prompt, irresponsible, unreliable	High-scoring individuals are dependable, reliable, and make every effort to keep their promises.
	Non-Delinquency	rule-following, lawful, delinquent	High-scoring individuals tend to comply with rules, customs, norms, and expectations, and they tend not to challenge authority.
	Virtue	honest, frank, misleading	High-scoring individuals strive to adhere to standards of honesty, morality, and "good Samaritan" behavior.
Emotional Stability	Adjustment	ambitious, industrious, aimless	High scoring individuals are seen as hard working, ambitious, confident, and resourceful.
	Even-Tempered	calm, composed, moody, hot-headed	High-scoring individuals tend to be calm and stable. They don't often exhibit anger, hostility, or aggression.
	Optimism	happy, optimistic, depressed, dejected	High-scoring individuals have a positive outlook on life and tend to experience joy and a sense of well-being.
Openness To Experience	Intellectual Efficiency	intelligent, analytical, knowledgeable	High-scoring individuals believe they process information and make decisions quickly; they see themselves (and they may be perceived by others) as

Big Five Factor	TAPAS Facet	Key Adjectives	Brief Description
			knowledgeable, astute, or intellectual.
	Ingenuity	creative, inventive, unimaginative	High-scoring individuals are inventive and can think "outside of the box"
	Tolerance	tolerant, broadminded, biased	High-scoring individuals scoring are interested in other cultures and opinions that may differ from their own.
Outside of Big Five Framework	Commitment to Serve		High-scoring individuals identify with the military and have a strong desire to serve their country.
	Courage		High-scoring individuals stand up to the challenges and are not afraid to face dangerous situations.
	Team Orientation		High-scoring individuals prefer working in teams and make people work together better.

Note. This table is a combination of two tables from Development of the Tailored Adaptive Personality Assessment System (TAPAS) to Support Army Personnel Selection and Classification Decisions, by Drasgow et al., 2012, pp. 39–40, 91. Facet names, adjectives, and descriptions have been copied directly from tables 2.11(pp. 39–40) and 7.1 (pp. 91).

Table 2 provides a summary of the descriptive statistics of both the independent and dependent variables we use in our analysis. The individual units of each TAPAS theta are measured in the standard deviation based on all test takers. Whenever we refer to an increase unit in a given TAPAS theta, we are referring to the standard deviation.

Table 2.   Descriptive statistics of variables

Variable	Number of Values	min	max	range	median	mean	SE.mean	CI mean 0.95	variance	standard deviation	Coeff variance
OOM	398	3	1031	1028	562.5	549.07	14.17	27.85	79858.40	282.59	0.51
SECOND CL SPRING AOM	382	1	1063	1062	598	582.22	14.74	28.97	82942.37	288.00	0.49
SECOND CL SPRING MOM	382	3	1066	1063	473	480.19	14.14	27.80	76377.73	276.37	0.58
SECOND CL SPRING OOM	382	1	1064	1063	590	558.03	14.62	28.74	81618.82	285.69	0.51
spcGrade	398	60	100	40	84	82.82	0.54	1.05	113.99	10.68	0.13
Peer Rank	398	1	33	32	13	13.97	0.44	0.86	75.71	8.70	0.62
LN Score	398	60	100	40	83.75	82.91	0.52	1.01	105.88	10.29	0.12
Board Score	398	62.14	99.83	37.69	81.56	81.29	0.42	0.83	70.72	8.41	0.10
Achievement Theta	398	-1.19	1.91	3.10	0.46	0.41	0.03	0.06	0.35	0.59	1.43
Adjustment Theta	398	-1.93	2.00	3.92	-0.03	0.02	0.03	0.07	0.48	0.69	33.38
CommitmenttoServe Theta	398	-1.33	0.79	2.12	-0.18	-0.13	0.03	0.06	0.34	0.58	-4.64
Courage Theta	398	-1.63	2.35	3.98	0.29	0.38	0.04	0.08	0.69	0.83	2.20
Dominance Theta	398	-1.76	1.93	3.70	0.12	0.15	0.03	0.06	0.35	0.59	3.91
EvenTempered Theta	398	-1.69	2.11	3.80	0.32	0.26	0.04	0.07	0.54	0.73	2.78
Ingenuity Theta	398	-2.41	1.74	4.15	-0.31	-0.36	0.04	0.08	0.63	0.79	-2.23
IntellectualEfficiency Theta	398	-1.72	2.35	4.07	-0.19	-0.10	0.04	0.08	0.60	0.77	-7.56
Non-Delinquency Theta	398	-2.05	1.52	3.57	-0.65	-0.66	0.03	0.06	0.31	0.56	-0.86
Optimism Theta	398	-1.78	1.73	3.51	0.24	0.18	0.03	0.06	0.36	0.60	3.25
Order Theta	398	-2.57	1.67	4.24	-0.45	-0.40	0.04	0.08	0.65	0.81	-2.00
PhysicalConditioning Theta	398	-1.65	2.47	4.11	0.79	0.68	0.04	0.08	0.58	0.76	1.13
Responsibility Theta	398	-1.39	1.69	3.09	-0.03	-0.02	0.03	0.05	0.31	0.55	-27.37
Selflessness Theta	398	-2.22	1.44	3.66	-0.13	-0.22	0.03	0.06	0.36	0.60	-2.70
Sociability Theta	398	-1.72	1.64	3.36	-0.09	-0.09	0.03	0.07	0.48	0.69	-7.81
TeamOrientation Theta	398	-1.59	1.37	2.96	-0.23	-0.22	0.02	0.05	0.25	0.50	-2.23
Tolerance Theta	398	-2.41	1.41	3.82	-0.42	-0.46	0.04	0.08	0.66	0.81	-1.75
Virtue Theta	398	-1.36	2.30	3.66	0.53	0.54	0.03	0.07	0.45	0.67	1.24
Acadmics.Standing	398	1	291	290	96.5	112.22	3.83	7.52	5825.93	76.33	0.68
Military.Skills.Standing	398	1	281	280	116.5	120.54	3.83	7.52	5828.08	76.34	0.63
Leadership.Standing	398	1	285	284	61	84.38	3.79	7.44	5707.14	75.55	0.90
Overall.Standing	398	1	290	289	106.5	115.32	3.75	7.38	5606.98	74.88	0.65

2.   MARSATS DATA

Additional independent variables that we analyze include performance data from the USNA MarDet Marine Recruiting and Service Assignment Tracking System (MaRSATS). MaRSATS is a system the USNA MarDet maintains to store performance data from various training evolutions to include Leatherneck. Leatherneck is a training

program run every summer by the MarDet, which serves as an opportunity for professional development and is an objective individual assessment for those interested in commissioning as a Marine Corps Officer. An individual who commissions as a Marine Corps Officer must complete certain requirements set forth by the Marine Corps, and Leatherneck covers a portion of those requirements for those who commission from the Naval Academy. As it is a requirement for Marine Officer selection, it provides an ideal opportunity to collect data on all Marine Corps Officer accessions for the Naval Academy.

Midshipmen who attend Leatherneck receive an overall grade and platoon ranking based on both quantitative and qualitative data. The qualitative grades include the physical fitness test (PFT), obstacle course, endurance course, leadership reaction course (LRC), and academics. We name the overall grade they receive as "Leatherneck score," or "LN score" for short. Qualitative grades include peer ranking within the platoon and an SPC assessment. In our analysis, we name these metrics "peer rank" and "SPC grade." We assign Leatherneck score and SPC grade on a scale of 60 to 100, with 60 being the lowest score we give to the lowest performers and 100 being the highest score we give to the top performers. We assign peer rank on a scale from 1 to however many individuals are in the platoon, with 1 being the rank of the highest performer in the platoon.

In addition to the Leatherneck performance metrics of SPC grade, peer rank, and Leatherneck score, we use the metric "board score" from MaRSATS. The board score is established as the MarDet goes through the selection process for those who commission as Marine Corps Officers. The board score is weighted based on Overall Order of Merit (OOM), Academic Order of Merit (AOM), and Leatherneck score, with each being weighted as one-third of the board score. We also grade this on a 60 to 100 scale. The summary statistics for all MaRSATS data variables can be found in Table 2.

3.   USNA Data

A final group of independent variables we analyze includes performance data from the USNA. There are numerous ways midshipmen are evaluated while they are at the Naval Academy. We focus on three specific measures of performance: overall order of merit (OOM), military order of merit (MOM), and academic order of merit (AOM). OOM is a

combination of a midshipman's performance in MOM and AOM. MOM is a midshipman's ranking based on their military quality point ranking (MQPR). MQPR is based on a midshipman's performance in physical education, athletics, aptitude, and conduct. AOM is a midshipmen's rank in their class based on their quality point ratio (QPR), which is similar to the grade point average system most colleges use. A midshipman's QPR is based on their grades in the academic classes. We base each rank on a scale of 1 to however many midshipmen are in their class, usually around 1,000 to 1,200. The midshipman who is ranked 1 is the highest performer in each of those categories.

For our analysis, we specifically focus on the OOM, MOM, and AOM the midshipmen have at the end of the spring semester of their 2/C year. We focus on this time period because these are the rankings the MarDet takes into consideration during the selection process for future Marine Corps Officers. The summary statistics for the USNA data variables are found in Table 2.

B.   DEPENDENT VARIABLES

The main dependent variable for this study is the overall ranking for each USNA-produced Second Lieutenant evaluated at TBS. As mentioned previously, while at TBS, Marine Corps Second Lieutenants are graded in three categories: Military Skills, Academics, and Leadership. Those three composite scores are then aggregated, and the officer is assigned a class ranking. We use the independent variables to assess the overall class ranking as well as the officer's performance within the three subcategories. Finally, we also evaluate the Midshipman's performance at the Naval Academy and Leatherneck training evolution to assess if performance at the Naval Academy and Leatherneck translates to performance at TBS.

1.   TBS Grading Breakdown

As stated previously, Second Lieutenants are graded in academics, military skills, and leadership while at TBS with academics and military skills each making up 30 percent of the officer's final grade, and leadership making up 40 percent of the officer's final grade. A TBS company typically consists of between 290 to 300 student officers. The academic portion of the grade is made up of four total exams as TBS is broken up into four phases.

The leadership category of an officer's grade is made up of three leadership evaluations and a leadership exam. The leadership evaluations are based on the Staff Platoon Commander's (SPC) evaluation of the student officer as well as peer rankings from other members of the student officer's platoon. Finally, the military skills portion of the overall grade is made up of several events that all student officers participate in while at TBS. Those events include the rifle and pistol range, communications practical application, combat lifesaving, day and night land navigation, crew-served weapons evaluations, combat orders evaluation, two tactical decision-making evaluations, the double obstacle course, the endurance course, and the physical fitness test and combat fitness test.

After the final grades are calculated, officers are ranked and broken up into three thirds to ensure a quality spread for MOS selection. Additionally, the top 15 percent of the training company are meritoriously career designated. This means they no longer compete on a board for career designation if they choose to stay in the Marine Corps past their initial service obligation, it is automatically granted to them.

The final grades are stored at TBS. The DC, M&RA pulls that data from TBS and maintains the information for research. M&RA has provided TBS performance data to the researchers for 2019, 2020, and 2021 Naval Academy graduates who participated in TAPAS data collection while attending Leatherneck. The descriptive statistics for the TBS ranking variables are found in Table 2.

C.   THE SAMPLE

For this study, we use TAPAS data collected from Leatherneck during the summers of 2018 and 2019 for evaluation. There is no TAPAS data collected from 2020 because of complications due to the COVID-19 pandemic. Between 2018 and 2019, there are 865 midshipmen that participated and completed the TAPAS assessment. Since not everyone who completes Leatherneck commissions as a Marine Corps Officer, when analyzing the data from TBS we use the TAPAS scores for the individuals who attended Leatherneck, commissioned as a Marine Corps Officer, and graduated from TBS at the time we received the data from M&RA. This population consists of 398 Marine Corps Officers. For the analyses in which we add MaRSATS and USNA data, there are some gaps in the data. Due

to these gaps, the total population for analyses that add those factors consists of 382 Marine Corps Officers.

D.   DATA ANALYSIS PROCEDURES

Our first step in the data analysis is to assess how each TAPAS facet are associated with the dependent variables of overall, academic, military skills, and leadership standing for TBS. Using a correlation table created by the apaTables package in R Studio, we assess what correlations are present between the dependent and independent variables and which are statistically significant.

We conduct several multiple regression analyses using the lm function in R Studio. We first run four multiple regression analyses to test which TAPAS facets are associated with overall, academic, military skills, and leadership standing at TBS. We then run three multiple regression analyses to test three different models for predicting overall standing at TBS. We create a TAPAS model that uses just the TAPAS facets to predict overall standing, a USNA model that uses quantitative measures the MarDet already uses in the officer selection process, and finally, we create a model that combines the TAPAS facets with the USNA data. We test if adding TAPAS to the USNA model creates a better model through an analysis of variance (ANOVA).

E.   HYPOTHESES

As we look at our data from psychological and management perspectives, we have two categories of hypotheses. The first category addresses the management perspective, specifically if adding TAPAS to current selection models will create a better model. The second category of hypotheses address the psychological perspective and how we expect the facets of TAPAS to relate to TBS performance, specifically which facets are associated with higher performers. We group the TAPAS hypotheses based on the Big Five Factors as described in Table 1.

1. Regression Model Hypotheses

We conduct a nested comparison to test if the combined USNA and TAPAS models are better at predicting overall TBS standing than just the USNA model alone. We do this specifically through an ANOVA test. The null and alternative hypotheses are shown below.

$H1_o$: A model with MIDN Performance and TAPAS performance performs just as well as a model with just MIDN Performance.

$H1_A$: A model with MIDN Performance and TAPAS is better than a model with just MIDN performance.

$\alpha = 0.05$

2. TAPAS Hypotheses

H2, Extraversion: The TAPAS facets of dominance and physical conditioning are positively associated with overall TBS performance, with dominance also being positively associated with leadership standing and physical conditioning being positively associated with military skills. The facet of sociability has minimal to no association with TBS performance. We expect that dominance has a positive association with performance because previous research has shown it to be a large predictor of attrition in entry-level training (Turpin, 2014). We expect it is specifically associated with leadership standing due to those who score high in dominance are often viewed as assertive and natural leaders, which translates to performance in leadership evaluations. We expect physical conditioning is positively associated with overall performance because research shows that soldiers who score higher on the physical conditioning facet are less likely to attrite during their first year of service (Hushes et al. 2020). As TBS is entry-level training for officers and contains physically rigorous training, we anticipate seeing a similar trend. We anticipate military skills standing specifically being associated with physical conditioning because it accounts for the physical graded events like the endurance course and obstacle course.

H3, Agreeableness: The TAPAS facet of selflessness has no association with TBS performance. In our review of the literature, we did not find any studies that found

selflessness as an indicator of attrition or performance. While the military and the Marine Corp tend to espouse the idea of selflessness as an important trait in military members and leaders, due to the competitive nature and types of evaluations in entry-level training like TBS, we expect it is not associated with performance in those contexts.

H4, Conscientiousness: The TAPAS facet of achievement are positively associated with all measures TBS performance. The other facets of order, non-delinquency, virtue, and responsibility have minimal to no association with TBS performance. A West Point study conducted by Bartone et al. (2009) shows conscientiousness to be a predictor of leader performance during the academic year and numerous other studies have shown a connection between conscientiousness and academic performance in both the military and civilian context (Fosse et al., 2016; George et al., 2001; Goldberg et al., 1998). Given this, we hypothesize the facet of achievement is associated with academic performance. It is also associated with military skills and leadership performance because of the hard-working, ambitious, and resourceful nature of those who score high in achievement. We expect the other facets are not correlated with performance, especially with the population coming out of the USNA because the facets like non-delinquency, virtue, and responsibility are a focus of development for the USNA. Those who are lower in the facets are less likely to have made it through the selection process and four years at the USNA.

H5, Emotional Stability (Neuroticism): The TAPAS facet of adjustment is positively associated with overall TBS performance, as well as military skills standing. Optimism and even-tempered has minimal to no association with TBS performance. While we did not find any specific literature on adjustment being associated with retention and performance, we expect that those who tend to be more ambitious, confident, and resourceful perform better in the competitive and stressful environment that TBS creates. We have not found any research that indicates the TAPAS facets of optimism and even-tempered would positively correlate with performance, and given what we know of the training schedule we do not anticipate these facets having a significant relationship to performance.

H6, Openness: The TAPAS facets of intellectual efficiency and ingenuity are positively associated with overall and academic TBS performance, while tolerance will be

minimally associated. Given that intellectual efficiency deals with intelligence and the ability to process information and make decisions quickly, those who are high in this facet perform better in academics which also leads to an increase in overall performance ranking. While we do not have any specific research as backup, we expect that ingenuity is also associated with higher performance in this setting due to the nature of evaluations at TBS. Officers at TBS are put in situations where they make decisions without a lot of information, so those who think "outside the box" should have to ability to perform better in those uncertain situations.

H7, Outside of Big Five Framework: The TAPAS facet of courage is positively associated with overall TBS performance, as well as military skills standing. Commitment to serve and team orientation have minimal to no association with TBS performance. With courage being a newer facet added to TAPAS, there are not many studies that have included it in their research. Given the description of high performing individuals in Table 1, those who are not afraid to face challenges, rise to the challenges at TBS, resulting in higher performance. Commitment to serve and team orientation have minimal to no association because those who make it to this point of training already show a commitment to serve, and team orientation is not going to distinguish officers due to the competitive nature.

F.   SUMMARY

In this study we evaluate the dependent variables of overall, academic, military skills, and leadership standings at TBS. We analyze how these dependent variables are influenced by the independent variables of TAPAS facets, MaRSATS Data, and USNA Data. From a management perspective, we use regression models and ANOVA tests to evaluate if adding TAPAS facets to the MaRSATS and USNA data already used, creates a better officer selection model for the MarDet. From a psychological perspective, we use correlation tables to analyze the association of TAPAS facets with TBS performance to evaluate if there are individual non-cognitive facets that are associated with higher performers.

IV.   DATA ANALYSIS

In this chapter we go through the results of the correlations tables, the regression analysis, and the ANOVA test.

A.   TBS STANDINGS EVALUATION

In evaluating the correlation between TAPAS facets and the measures of standing at TBS, several TAPAS facets are shown to be statistically significant. As stated previously, for this study we not only look at the overall class standing at TBS, but also the standing for military skills, academics, and leadership; all three of which make up the overall class standing for individual Lieutenants. For determining significance, those facets that display a 0.05 level of significance or better are the facets that we use to determine if the facet is positively or negatively correlated to performance at TBS.

As shown in the correlation table seen in Table 3, seven TAPAS facets are significantly correlated to overall class standing at TBS ($p<.05$). Achievement, intellectual efficiency, and optimism are positively correlated with overall standing. Selflessness, sociability, and tolerance are all shown to be negatively correlated with overall standing. Academic standing has eight TAPAS showing a significant correlation. This shows similar trends to overall standing except, instead of ingenuity showing a negative correlation, physical conditioning shows a negative correlation and order shows a positive correlation with academic standing ($p<.05$). However, from a practical standpoint, the correlations for all standings measures are relatively weak, as they are between -.17 and .25.

Table 3.   Means, standard deviations, and correlations with confidence intervals for TBS Standing's variables in relation to TAPAS Facets

Variable	M	SD	Achievement Theta	Adjustment Theta	Commitment to Serve Theta	Courage Theta	Dominance Theta	Even Tempered Theta	Ingenuity Theta	Intellectual Efficiency Theta	Non-Delinquency Theta	Optimism Theta	Order Theta	Physical Conditioning Theta	Responsibility Theta	Selflessness Theta	Sociability Theta	Team Orientation Theta	Tolerance Theta	Virtue Theta
Overall Standing	115.32	74.88	.17**	0.01	0.04	0.09	0.04	-0.03	-0.11*	.18**	-0.04	.20**	0.04	0	-0.04	-.11*	-.15**	-0.02	-.15**	0.09
			[.08, .27]	[-.09, .11]	[-.06, .14]	[.00, .19]	[-.06, .14]	[-.13, .07]	[-.21, -.02]	[.08, .27]	[-.14, .06]	[.10, .29]	[-.06, .14]	[-.10, .10]	[-.13, .06]	[-.21, -.01]	[-.25, -.05]	[-.11, .08]	[-.24, -.05]	[-.01, .19]
Academics Standing	112.22	76.33	.11*	-0.01	0.04	-0.03	0	-0.05	-0.09	.25**	0.03	.11*	.12*	-.11*	-0.02	-.12*	-.24**	-0.09	-0.17**	0.1
			[.02, .21]	[-.11, .09]	[-.05, .14]	[-.13, .07]	[-.10, .10]	[-.15, .05]	[-.19, .01]	[.16, .34]	[-.07, .13]	[.02, .21]	[.02, .21]	[-.21, -.01]	[-.08, .12]	[-.21, -.02]	[-.33, -.14]	[-.19, .00]	[-.26, -.07]	[.00, .19]
Military Skills Standing	120.54	76.34	0.09	0.08	-0.06	.11*	-0.03	0.03	-0.04	.15**	-0.06	.24**	-0.02	-0.01	-0.06	-0.08	-.15**	0.04	-.11*	0.1
			[-.28, -.09]	[-.04, .16]	[-.18, .02]	[.00, .19]	[-.09, .11]	[-.16, .03]	[.00, .20]	[-.07, .13]	[-.31, -.12]	[-.15, .05]	[-.17, .02]	[.02, .22]	[-.40, -.22]	[-.24, -.04]	[-.02, .17]	[-.13, .06]	[.05, .24]	
Leadership Standing	84.38	75.55	.13*	-0.04	-0.02	.12*	0.08	0.06	-0.09	0.02	-0.09	.13**	-0.01	0.06	-0.06	0	0.02	0.05	0.02	0.02
			[.03, .22]	[-.14, .06]	[-.11, .08]	[.02, .21]	[.02, .17]	[-.04, .16]	[-.19, .01]	[-.08, .12]	[-.18, .01]	[.03, .22]	[-.11., .08]	[-.04, .15]	[-.15, .04]	[-.10, .10]	[-.08, .12]	[-.05, .14]	[-.08, .12]	[-.08, .12]

Note. M and SD are used to represent mean and standard deviation, respectively. Values in square brackets indicate the 95% confidence interval for each correlation. The confidence interval is a plausible range of population correlations that could have caused the sample correlation (Cumming, 2014). * indicates *p* < .05. ** indicates *p* < .01.

The results of the regression models for overall, academic, leadership, and military skills standing can be seen in Table 4. Beginning with overall standing, five out of the 18 facets show a statistically significant association with rank ($p<.05$). Those facets are achievement, ingenuity, intellectual efficiency, optimism, and sociability. Optimism was the single best facet at predicting where a Lieutenant finishes regarding overall class standing at TBS. These results are reflected in Table 3. According to the data, a unit increased in optimism theta is associated with an improvement of a student's overall class rank by up to 26 spots. Since a typical TBS class has roughly 300 lieutenants in the company, this would be the equivalent of moving from the middle of a given third to the top of a given third. The achievement facet and intellectual efficiency facet are both associated with an improvement in a student's overall standing at TBS by 17 and 12 spots respectively.

On the opposite end of the spectrum, the sociability theta is negatively associated with a student's overall ranking. This decrease, as with the 26-spot improvement for optimism, is associated with a student moving from the top of a given third to the middle of that same third, decreasing the likelihood of them getting the MOS they desire. This result does not support hypothesis two, in which we predicted that sociability has a minimal impact on TBS performance. An increased unit of ingenuity is also associated with a decrease in a student's overall standing, which is interesting since ingenuity is defined as being able to "think outside the box"; something that tends to be viewed as a positive trait for officers in the Marine Corps, especially in tactical environments. It is worth acknowledging that many of the training events at TBS have been conducted for several years. This lends to the fact that many of the solutions to these events have been seen over and over, likely contributing to the fact that ingenuity is negatively correlated with performance. Nevertheless, this does not support hypothesis seven in which we predict a higher ingenuity increases a student's standing in a TBS class.

As shown in the correlation table in Table 3, regarding the military skills standing, courage, intellectual efficiency, and optimism show positive correlations with this metric. Sociability, as well as tolerance, continue to show a negative correlation. Moving into the regression model, the optimism theta is by far the single highest predictor of military skills

ranking. A higher optimism score is associated with an improvement in a student's military skills ranking by up to 31 spots. Intellectual efficiency, virtue, and courage also show improvement in military skills standing by roughly 12, 12, and 10 spots respectively. A higher sociability score, however, continues to drive down a student's ranking. In the case of military skills rankings, sociability is the lone facet that is statistically significant and it will hurt a student's ranking by about 21 spots.

Finally, we look at the leadership standing metric, which is the highest weighted metric at TBS, making up 40 percent of a Lieutenant's overall grade and standing. Achievement, optimism, and courage continue to show a positive correlation with the leadership standing metric. For this specific metric, none of the TAPAS facets that are negatively correlated are statistically significant. Moving into a regression analysis in Table 4, achievement and optimism are associated with an improvement in a student's leadership ranking by roughly 15 spots at TBS, with courage not too far behind at 11 spots. Adjustment shows to be significant in the regression model, associated with a decrease in a student's ranking by about 13 spots.

Table 4.   Results of regression analysis for overall, academic, leadership, and military skills standings at TBS using TAPAS facets as independent variables

	Dependent variable:			
	Overall Standing (1)	Academic Standing (2)	Leadership Standing (3)	Military Skills Standing (4)
Achievement_Theta	-17.109*** (6.593)	-10.409 (6.637)	-15.274** (6.955)	-8.368 (6.711)
Adjustment_Theta	7.287 (5.595)	6.024 (5.633)	13.078** (5.903)	3.138 (5.696)
CommitmenttoServe_Theta	1.380 (6.334)	-0.087 (6.376)	6.287 (6.682)	11.113* (6.448)
Courage_Theta	-9.357* (4.876)	1.292 (4.908)	-11.624** (5.143)	-10.300** (4.963)
Dominance_Theta	-2.967 (6.900)	-3.178 (6.946)	-10.337 (7.279)	8.385 (7.024)
EvenTempered_Theta	4.785 (5.114)	5.684 (5.149)	-7.065 (5.395)	1.183 (5.207)
Ingenuity_Theta	9.883** (5.023)	6.866 (5.057)	13.515** (5.299)	2.557 (5.114)
IntellectualEfficiency_Theta	-12.403** (5.072)	-21.719*** (5.106)	0.381 (5.351)	-12.923** (5.163)
`Non-Delinquency_Theta`	9.401 (7.181)	6.151 (7.230)	9.947 (7.576)	9.790 (7.311)
Optimism_Theta	-26.799*** (6.214)	-20.828*** (6.256)	-15.435** (6.555)	-31.963*** (6.326)
Order_Theta	-2.701 (4.888)	-4.796 (4.921)	-3.235 (5.156)	1.105 (4.976)
PhysicalConditioning_Theta	5.919 (5.211)	11.207** (5.246)	4.487 (5.497)	5.404 (5.304)
Responsibility_Theta	11.053 (7.212)	9.315 (7.261)	13.623* (7.609)	11.958 (7.342)
Selflessness_Theta	3.307 (6.699)	3.625 (6.744)	-2.745 (7.067)	5.325 (6.819)
Sociability_Theta	21.705*** (5.728)	26.647*** (5.767)	5.388 (6.043)	21.538*** (5.832)
TeamOrientation_Theta	-7.940 (7.726)	-3.045 (7.778)	-7.536 (8.150)	-14.016* (7.865)
Tolerance_Theta	4.572 (4.977)	4.273 (5.011)	-4.893 (5.251)	4.989 (5.067)
Virtue_Theta	-7.802 (5.850)	-7.245 (5.889)	-2.361 (6.171)	-12.176** (5.955)
Constant	140.886*** (8.490)	122.068*** (8.547)	106.368*** (8.956)	145.492*** (8.643)
Observations	398	398	398	398
R2	0.164	0.185	0.086	0.167
Adjusted R2	0.125	0.146	0.043	0.127
Residual Std. Error (df = 379)	70.057	70.528	73.906	71.319
F Statistic (df = 18; 379)	4.141***	4.777***	1.989***	4.216***

Note: *p<0.1; **p<0.05; ***p<0.01

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B. TAPAS AND USNA DATA COMBINED

For the purposes of validating the TAPAS data and results and comparing it to the process that is already in place for selecting Midshipmen to become Marine officers, we conduct a regression analysis with data the MarDet uses for the selection process. To start we create a correlation table comparing selected data from the USNA that is used in the selection process to the standings metrics at TBS, which can be seen in Table 5. All of the USNA performance metrics are significantly correlated to each of the standings metrics at TBS (p<.01).

Table 5. Means, standard deviations, and correlations with confidence intervals for USNA performance metrics in relation to TBS Standings

Variable	M	SD	2/C Spring AOM	2/C Spring MOM	2/C Spring OOM	spcGrade	Peer Rank	LN Score	Board Score
Acadmics Standing	112.22	76.33	.64**	.58**	.65**	.22**	.15**	.22**	.62**
			[.58, .70]	[.51, .64]	[.59, .71]	[.13, .31]	[.05, .24]	[.12, .31]	[.56, .68]
Military Skills Standing	120.54	76.34	.40**	.44**	.44**	.28**	.29**	.30**	.48**
			[.32, .49]	[.36, .52]	[.35, .52]	[.19, .37]	[.20, .38]	[.21, .39]	[.40, .55]
Leadership Standing	84.38	75.55	.23**	.25**	.25**	.42**	.37**	.44**	.38**
			[.13, .32]	[.15, .34]	[.15, .34]	[.34, .50]	[.29, .45]	[.35, .51]	[.29, .46]
Overall Standing	115.32	74.88	.56**	.57**	.59**	.43**	.36**	.44**	.66**
			[.49, .63]	[.50, .63]	[.52, .65]	[.35, .51]	[.27, .44]	[.36, .52]	[.60, .72]

Note. M and SD are used to represent mean and standard deviation, respectively. Values in square brackets indicate the 95% confidence interval for each correlation. The confidence interval is a plausible range of population correlations that could have caused the sample correlation (Cumming, 2014). * indicates p < .05. ** indicates p < .01.

Next, we conduct a regression using only the USNA data, while continuing to use the overall TBS standing as the dependent variable. The independent variables for the USNA data are Second Class year AOM, Second class year MOM, and Leatherneck score. For our regression analysis, we choose to focus on these three variables because they do not have other variables nested within them. For example, OOM is a combination of AOM and MOM, and board score is a combination of OOM, MOM, and leatherneck score.

With a significantly higher R-squared value of 0.43, compared to just 0.16 for the TAPAS model, the model with just USNA data explains far more of the variation in the data. The Leatherneck score is the more important factor in terms of association with performance at TBS. According to the data, for every increase of a point for a Midshipman's Leatherneck score, there is an associated improvement in their TBS ranking by two spots.

Next, we run a regression that combines the TAPAS and USNA factors. The adjusted R-squared value of the combined model is 0.455, which is larger than either of the other two models, but not much larger than the USNA model. To verify if this is a significant increase, we conduct a nested comparison to test hypothesis 1. In running an ANOVA test, the results show a p-value of 0.011, allowing us to reject the null hypothesis and conclude there is a statistically significant improvement in the combined model versus the USNA model ($p < .05$).

By combining the data, the results from the addition of USNA data help to better account for some of the TAPAS results that had been seen previously. For example, using TAPAS alone, for every increase in a unit of optimism theta, a Lieutenant sees an associated increase in their overall ranking by roughly 26 spots. The combined model shows an association of only 13 spots. While 13 spaces is still a solid jump, the number being cut in half suggests the MarDet data already explains much of the variance in overall standing. This trend is seen on multiple occasions. The sociability theta sees an associated rank decrease of 21 spots cut to just nine spots. Higher intellectual efficiency went from an associated 12-spot increase to not being statistically significant at all. Those are just a few instances.

In conclusion, combining TAPAS data with the USNA data into one model modestly improves the fit and would likely marginally improve the ability of the MarDet to forecast a midshipman's performance at TBS as a Second Lieutenant. Future research using this method of combining data sets could potentially yield even better results.

Table 6. Results of Regression Analysis for Overall TBS Standing Using the TAPAS, USNA, and Models

| | Dependent variable: Overall Standing | | |
	TAPAS Model	USNA Model	Combined Model
Achievement_Theta	-17.109***		-11.317**
	(6.593)		(5.353)
Adjustment_Theta	7.287		2.452
	(5.595)		(4.426)
CommitmenttoServe_Theta	1.380		2.346
	(6.334)		(5.031)
Courage_Theta	-9.357*		-12.775***
	(4.876)		(3.867)
Dominance_Theta	-2.967		5.554
	(6.900)		(5.554)
EvenTempered_Theta	4.785		6.869*
	(5.114)		(4.068)
Ingenuity_Theta	9.883**		1.291
	(5.023)		(4.032)
IntellectualEfficiency_Theta	-12.403**		2.327
	(5.072)		(4.218)
`Non-Delinquency_Theta`	9.401		3.051
	(7.181)		(5.759)
Optimism_Theta	-26.799***		-13.791***
	(6.214)		(5.083)
Order_Theta	-2.701		-1.015
	(4.888)		(3.882)
PhysicalConditioning_Theta	5.919		5.704
	(5.211)		(4.237)
Responsibility_Theta	11.053		4.718
	(7.212)		(5.736)
Selflessness_Theta	3.307		2.821
	(6.699)		(5.466)
Sociability_Theta	21.705***		9.118*
	(5.728)		(4.637)
TeamOrientation_Theta	-7.940		-7.378
	(7.726)		(6.206)
Tolerance_Theta	4.572		5.302
	(4.977)		(3.968)
Virtue_Theta	-7.802		5.712
	(5.850)		(4.759)
SECOND_CL_SPRING_AOM		0.083***	0.068***
		(0.015)	(0.016)
SECOND_CL_SPRING_MOM		0.061***	0.074***
		(0.016)	(0.017)
`LN Score`		-2.001***	-1.785***
		(0.297)	(0.305)
Constant	140.886***	204.073***	196.174***
	(8.490)	(27.134)	(27.994)
Observations	398	382	382
R2	0.164	0.434	0.485

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Adjusted R2                         0.125              0.430              0.455
Residual Std. Error         70.057 (df = 379)     55.880 (df = 378)    54.630 (df = 360)
F Statistic          4.141*** (df = 18; 379) 96.640*** (df = 3; 378) 16.134*** (df = 21; 360)
========================================================================================
Note:                                              *p<0.1; **p<0.05; ***p<0.01
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C. SUMMARY

Throughout the data analysis, we continue to see evidence that TAPAS does, to an extent, predict overall performance and TBS for USNA-produced officers. The biggest surprise from the data that was analyzed was that the ingenuity facet is negatively correlated with performance. Frankly, this does make sense for the TBS environment. The evaluations and training events that are conducted at TBS have been done thousands of times over the years. It is very likely that due to some of the training environment constraints there are only a few correct ways to complete certain evolutions and that exhibiting creativity actually puts you at a disadvantage rather than just doing what has worked over and over.

On the other hand, it is surprising since in the FMF, officers are expected to be creative and think outside the box. One might expect the Marine Corps to try to replicate environments where creativity is positively used since that is a trait that officers are expected to emulate. This is said with the understanding that some training events, especially live-fire ranges have to be extremely controlled due to safety considerations.

From a management standpoint, combining TAPAS with the existing selection framework appears to make the data slightly more reliable. This indicates that the combination of the data does help the selection process when it comes to selecting midshipmen to be Marine Officers. Additional research and a larger sample size with future classes is needed to further validate these conclusions.

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V. CONCLUSIONS

A. HYPOTHESES

1. Hypothesis 1: Regression Model

We find that a model with USNA performance data and TAPAS data, is better than a model with just USNA performance data. While there is a statistically significant difference between the combined model and just the USNA model, it appears to be a small one. With this in mind, we recommend that further research be done before incorporating TAPAS into the MarDet's Marine Officer selection process. We recommend that future research investigate the possibility of creating a model that incorporates specific facets that are associated with higher performers for this population into the current selection model.

2. Hypothesis 2: Extroversion

Our hypothesis for extraversion is not supported by our data models. Dominance and physical conditioning are not statistically significant in either the correlation tables or the regression models. This is interesting since, throughout the course of our literature review, dominance and physical conditioning are recurring facets that have significance for predicting performance throughout enlisted training within the armed forces. This disparity could possibly be explained due to USNA-produced Marine Officers having to adhere to stringent physical standards throughout their time at the USNA and in the selection process. Since the preponderance of Marine-select midshipmen are generally in top tier physical conditioning, the level of significance for that facet specifically would likely decrease as a result. Additionally, dominance is generally the largest predictor of attrition in enlisted service members. As with physical conditioning, midshipmen with dominance disparities could have already been weeded out in the service selection process at the USNA.

On the other hand, sociability continuously came up as a negative predictor of performance at TBS. This was interesting since a common leadership philosophy within the Marine Corps is to build relationships with those around you. It is likely that, while at TBS, those who focus more on relationship building and less on studying and developing

assignments such as company orders will see their scores in the ranking metrics fall significantly. Although we predicted that sociability has a minimal to no effect on TBS performance, seeing that it is so significantly negatively correlated is surprising.

3.   Hypothesis 3: Agreeableness

Our results support hypothesis 3 that selflessness has minimal to no association with TBS performance. This is not to say that Marine Officers going through TBS are selfish, however, there is a level of competitiveness when it comes to the curriculum at TBS. Since MOS spaces are finite, many Lieutenants realize there is a level of focus they need to have on themselves and their performance.

4.   Hypothesis 4: Conscientiousness

Our hypothesis equating achievement to a positive correlation with performance at TBS is supported by our results. Specifically, achievement is statistically significant with regard to overall standing and leadership standing. This validates our thought process that individuals who are more ambitious and confident tend to do better at TBS due to the nature and complexity of the leadership situations that Lieutenants are placed in. One interesting thing that we notice is that the virtue theta is statistically significant with regard to the military skills standing. One might expect officers coming from USNA to have some level of virtue since they are immersed in this culture for four years, however, it is difficult to explain why the virtue facet is only significant to the military skills standing and not any of the other three ranking metrics. Further research could be conducted to explain this.

5.   Hypothesis 5: Emotional Stability (Neuroticism)

Emotional stability proves to be the category where our hypothesis is least supported by our results. While the adjustment facet shows no significance in the correlation table, there is significance with adjustment in the regression model for the leadership standing metric. Specifically, those higher in adjustment tended to rank lower in their leadership standing. This seems to go against what one might expect. You would assume that someone who is relaxed and handles stress well performs better at TBS. However, factoring in the significance of peer leadership and the competitive nature at TBS

might explain why those who score lower in adjustment tend to perform better at TBS. Lieutenants who are more insecure about their leadership abilities, especially when comparing themselves to their peers, may feel the pressure to invest more time in improving their skills.

The optimism facet proves to be another area that predicts performance in a way we did not anticipate. Throughout our models, optimism is the single best predictor of performance at TBS across all the performance metrics. It is statistically significant within the correlations tables in overall standing as well as leadership, military skill, and academics. In the regression models, those who score higher in optimism see the largest ranking improvements in all four categories. This could be explained by the training environment at TBS. A common thought is that many officers view TBS as a "check in the box" so to speak. Many, especially those who do not desire to go into a combat arms MOS, tend to have a more negative attitude toward the training and daily schedule at TBS. Lieutenants with that attitude tend to be ranked lower by their peers and perform worse in combat arms-related tasks; especially toward the middle to end of TBS when many of the graded events are focused on the combat arms field. Looking at it from this perspective, it makes sense that individuals who exhibit a more positive outlook on life might perform better at TBS.

6. Hypothesis 6: Openness

Intellectual efficiency and ingenuity are statistically significant and positively correlated with at least one of the standing metrics for TBS. As one would expect, intellectual efficiency provides a ranking increase in the overall and academic ranking metric, as well as military skills. The military skills boost makes sense since many of the events in this category require the application of academic processes taught at TBS. Interestingly enough, those who score higher in ingenuity are actually shown to rank worse in overall and leadership standing when evaluating the regression models. The idea for people to not think outside the box tends to contradict what the Marine Corps looks for in its officers, however many of the tasks and assignments at TBS are fairly structured and presented in a manner where there are generally a few ways to accomplish something

effectively. This might explain why those higher in ingenuity rank worse at TBS. The need to really think outside the box will be more prevalent outside of TBS and in the FMF.

7.   Hypothesis 7: Outside of Big Five Framework

The courage facet is positively correlated and significant with military skills and leadership, which supports our initial hypothesis. Our regression analysis confirms this, showing that Lieutenants who score higher in courage tend to rank higher in both of those categories. Commitment to serve and team orientation are not statistically significant as we anticipated. This is likely because most officers coming from USNA have similar commitment to serve and team orientations as their peers. The curriculum at USNA ensures that Midshipmen are put into team environments and essentially everyone applying to come to USNA understands that there will be a service obligation upon their graduation.

B.   OVERALL

Overall, the achievement and optimism thetas continued to be the two best predictors of ranking increases across all the facets. While other facets in each metric show an associated improvement in rankings, optimism and achievement show the most significant rank increases within the regression models. On the other hand, sociability is the single largest predictor of ranking decreases among all the TAPAS facets. This is interesting since one might expect a person who is more open to initiating social relationships might score higher in certain areas, especially leadership metrics. In fact, the opposite is true according to the regression data. We interpret this as someone scoring higher in sociability might care more about the relationship and less about accomplishing a mission or task, since at times these two things could be at odds with one another. Someone who cares more about a relationship may be less willing to be firmer with another person in the pursuit of an objective.

While there were several facets that show the ability to predict better performance, more research is needed to confirm the extent of the performance that is predicted. Our scope only went as far as TBS, we recommend future research include a wider scope to include performance through a Marine officer's first tour in the FMF. This could help

determine if the trends in which TAPAS is correlated with performance are unique to the TBS environment or continue on outside of a school house environment.

Our research population from the USNA only includes those who attend Leatherneck because they are interested in the possibility of service selecting the Marine Corps. Future research could be done to administer TAPAS to a larger population within the Naval Academy. This would allow researchers to examine if the facets correlated with performance for those who service selected Marine Corps, are common across the different communities within the Navy and Marine Corps, or if different communities have different trends.

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