

NAVAL POSTGRADUATE SCHOOL Monterey, California



THESIS

**THE EFFECTS OF U.S. MARINE CORPS GRADUATE EDUCATION
PROGRAMS ON OFFICER PERFORMANCE: A COMPARATIVE ANALYSIS
OF PROFESSIONAL MILITARY EDUCATION AND GRADUATE
EDUCATION**

by

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March 2003

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ABSTRACT

This thesis compares the effects of Marine Corps graduate education programs, categorized as either Professional Military Education (PME) or Non-PME, on officer performance. The intent of the thesis is to provide empirical evidence to support or refute Marine Corps cultural perceptions that PME improves officer performance more than Non-PME graduate education. A performance index (PI) is derived from the current Marine Corps fitness report system and averaged before and after graduate education for PME and Non-PME graduates and for a group of officers without graduate education (NOS). Data from the Marine Corps Total Force Data Warehouse are used to assess the marginal effect of graduate education in models that also included demographic, affective and cognitive traits. ANOVA results for O4s show significant improvement in performance over time for all groups (PME, Non-PME and NOS), with the largest improvement for PME and the smallest for NOS, although differences between groups are not significant. Multivariate regressions indicate that, after accounting for other influences, the post-education performance of those with graduate education is not significantly different from those without (NOS). The change in performance between before and after receiving graduate education is not significantly different for PME and NOS, while it is slightly lower for Non-PME than for NOS (significant at .10 level). A limitation of the study is that the data only covered four years of fitness reports. Thus, we were not able to assess the long-run effects of graduate education on officer performance.

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I. INTRODUCTION

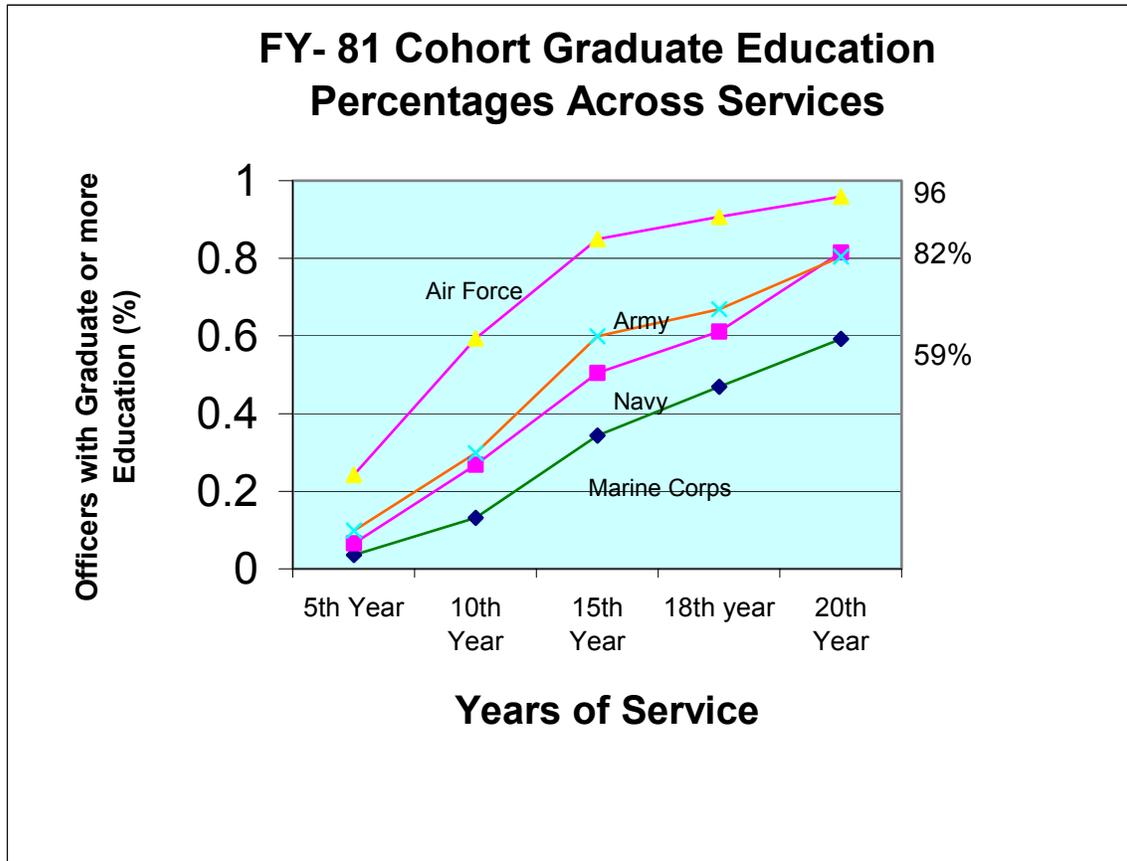
The Marine Corps is the United States' premier fighting force designed specifically to meet the immediate, complex and often unforeseen threats to our national security. As an organization, the Marine Corps is prepared for countless types of missions (combat or non-combat) through its ability to adapt to challenges over time. It is the attributes of Marine officers such as creative thinking, sound judgment and decisive action that result in this ability to adapt. As we embark on a new era of warfare where the threat is small terrorist factions instead of hostile nations, these attributes of Marines become increasingly important. Through effective education the Marine Corps can improve officers' ability to adapt to this volatile combat environment. For example, the benefit of Marine Corps graduate education programs is two fold: first it is expected that graduate education will enhance job performance; second, graduate education should provide an incentive for officers to remain on active duty. It is therefore imperative that the Marine Corps continue to assess existing education programs through empirical analysis of performance, retention and other benefits.

Central to maintaining highly effective officers is the Marine Corps' ability to educate officers beyond the baccalaureate level. Graduate education in disciplines that improve the ability of officers to function proficiently in an uncertain combat environment is the goal of Marine graduate education. It is expected that the investment in graduate education will yield as much if not more benefit to the Marine Corps' combat capability as investments in physical capital such as weapons, equipment, or aircraft. Unlike materiel or technology, an educated officer has the ability to function in a given environment but also to adapt to changes in that environment. Over time an educated officer can be proficient in numerous combat environments and scenarios, whereas materiel and equipment must constantly be updated and modified to meet new challenges. Additionally, a Marine officer who has matured during his career can then share what he has learned with junior officers. Thus, the benefits of graduate education to the Corps include: first, a proficient leader who can adapt to an uncertain and ever-

changing environment; and second, a mentor for subordinate officers who imbues knowledge and ensures that past experiences are not forgotten.

Military graduate education programs in each of the armed services were initiated separately and independently without any unifying doctrine or policy. The development of educational programs in each service was unique until the end of World War II. However, in 1945 the federal government imposed guidelines on all armed services with respect to officer education. The Joint Chiefs of Staff "chartered the Richardson Committee (1945) to examine the entire organizational structure of the military and recommend improvements based on the experiences of the war." (CJCSI 1800.01A pg. A-A-1). The result was the creation of the Department of Defense, which "strongly advocated establishing a system for joint education." (CJCSI 1800.01A pg. A-A-1). The Department of Defense placed a strong emphasis on knowledge acquisition, making it paramount to maintaining a capable and effective military, but offered no specific guidance or requirements for what military officers should learn or how that education should be administered.

The Marine Corps, like the other services, continued to commit time, effort and resources to the educational programs that were already in existence. However, no significant changes were made in what was being taught or how Marine officers were utilizing that knowledge. It was not until the Goldwater-Nichols Act of 1986 that any "intensive reassessment of the military educational system" took place. (CJCSI 1800.01A pg. A-A-1). In the years following the Goldwater-Nichols Act, the Marine Corps continued to place less emphasis on its educational programs, particularly at the graduate level, compared to the other services. The result has been the continuation of existing graduate programs, the creation of new programs with no clear goals and the fostering of a Marine Corps culture that values operational experience over education. Evidence of a culture that is averse to graduate education is shown in Figure 1.1, which finds Marine officers in the 1981 cohort are less likely to have graduate degrees than those in other services at all career points.



Source: DMDC cohort data from FY 1981 to FY 1998
 Note: data represents all officer accessions during FY81 for each service

Figure 1. Percent of Officers in 1981 Cohort with Graduate Education By Service

Today the Marine Corps, like the other services, finds itself struggling to maintain an effective fighting force as many of the officers who possess the valuable attributes of creative and analytical thinking and sound judgment are drawn out of the military into civilian employment. Marine Corps graduate education programs have thus taken on an additional role since the Goldwater-Nichols Act. They can be used as an effective weapon against officer attrition. Now more than ever, it is important to understand the effect graduate education programs have on officer performance and the role of graduate education in retention decisions.

Given the potential benefits of an educated and experienced officer, the Marine Corps needs to assess the relevant costs and returns of each of its officer graduate

education programs with the same level of scrutiny that is given to the effectiveness of new weapon systems.

A. BACKGROUND

There are several programs that offer Marine officers the opportunity to attain education beyond the baccalaureate level. These programs are varied but all purport to have similar educational objectives such as improving cognitive skills, creative thinking and judgment. Programs such as the Command and Staff College, Marine Corps War College, Special Education Program and Advanced Degree Program are a few that share the same goals. Despite the similarity of goals, the manner in which they achieve them varies significantly. Each program is controlled by different organizations within the Marine Corps and hence is allotted different resources. Moreover, there is no overarching policy that governs how all officer education programs are administered. Many differences exist, such as program duration, focus of curricula, duty status (e.g., resident or non-resident) and utilization of graduates. Despite these differences, our analysis of Marine graduate education programs groups all programs into two categories. Officer education programs are classified as either Professional Military Education (PME) or traditional graduate education (Non-PME).

PME programs are designed so that Marine officers can participate in them throughout an entire career of service. PME schools are structured as a step process that increases in duration, difficulty and scope. In 1989 all PME schools were consolidated under one command, the Marine Corps University, whose mission is:

Develop, execute, and evaluate professional military education focusing on leadership and our core competencies through resident and distance education Programs in order to prepare students to meet the challenges of present and future operational environments. (MCUmission, MCUonline, <http://www.mcu.usmc.mil/>).

Of the existing PME schools today, only two, the Command and Staff College (CSC) and the Marine Corps War College (MCWAR), offer a graduate degree for full-time (resident) students. The focus of these programs is inherently military in nature and does not go beyond the scope of Marine Corps and Joint doctrine and theory on force employment in various combat operations. Not all participants in the CSC and MCWAR

achieve graduate degrees; however, the course of study for all students is at the graduate level. Some officers in these programs are selected to complete additional writing requirements in order to achieve a Master's of Military Studies or Master's of Strategic Studies. The education offered by CSC and MCWAR resembles more traditional graduate education programs in its intent "to concentrate – for selected field grade officers – in decision-making and complex problem-solving experience at the operational level." (CSC Purpose and Mission, CSC online <http://www.mcu.usmc.mil/csc/purpose.htm>). Because CSC and MCWAR are PME schools, they are specifically addressed in various Marine Corps policies as being beneficial to officers for continued self-improvement and promotion. For example, the precepts for a recent Marine promotion board stated that PME schools are "a valuable and important aspect of a Marine officer's professional development" and "successful completion...represents a desire to prepare for positions of increased responsibility." (SECNAV, FY04 LtCol Promotion precept). The Marine Corps Order that establishes the requirements for PME completion at all grades refers to the 1989 Marine Corps University Charter, which intended to make PME "a main stream part of every Marine's career." (PME Order, MCO P1553.4A Dec 1999). It is the existence of these policies that creates a cultural perception among officers that PME schools are highly beneficial to the Corps and the individual attending. There is no adverse impact on an officer's career by undertaking PME graduate programs as the officer may return, upon completion, to his primary occupational field and serve in any billet that his career track will allow. Regardless of the many benefits of PME schools, some officers choose to participate in the other graduate education programs that the Marine Corps offers.

The Marine Corps graduate education programs that fall into the Non-PME category are more varied and are considered to be more traditional in that their curricula are structured similarly to civilian graduate programs. Programs such as the Special Education Program (SEP) and the Advanced Degree Program (ADP) fall into this category. Unlike PME, the Manpower and Reserve Affairs Division at Headquarters Marine Corps manage both SEP and ADP. They are similar to PME graduate programs in that they are resident programs, meaning that participation is an officer's full time duty. The educational objectives of SEP and ADP are also to sharpen analytical and problem-

solving skills. However, the goals of SEP and ADP are different from those of PME graduate programs. The mission of SEP and ADP, as stated below, is to prepare officers to serve in specific billets that require graduate education, which may or may not be similar to an officer's primary military occupational specialty (MOS):

The Marine Corps has identified and validated several hundred billets, which are required to be staffed by officers who possess postgraduate level education. The graduate education programs, Advanced Degree Program (ADP) and SEP were established as a means of providing the Marine Corps with a sufficient number of qualified officers to fill these billets. (SEP Order MCO 1520.9F May 1993)

Non-PME graduate degree disciplines (e.g., SEP and ADP) range from technical fields such as Computer Science and Operations Analysis to non-technical fields such as Accounting and Management. All of these have application in the Marine Corps but none are strictly military in nature.

Utilization of SEP and ADP graduates is more restrictive as compared to PME graduate education in that officers must serve in at least one specific staff billet where graduate education is required. Assignment to one of these specialized billets may be outside the normal career progression of an officer's primary MOS. Additionally, the same language in promotion policies that creates the perception that PME graduate education is highly beneficial to the individual officer, and therefore more appealing, does not exist for the Non-PME programs SEP or ADP. Marine officers, however, may choose to participate in Non-PME programs because of the broader range of degree disciplines and the potential for future benefit in the civilian labor market.

There are two other graduate degree programs that may be classified as Non-PME: the Funded Law Education Program (FLEP) and the Extended Leave Program, Law (ELP-L). Manpower and Reserve Affairs Division also manages FLEP and ELP-L but these programs serve a slightly different purpose. Officers participate in either of these programs to attain a law degree and become Marine Corps lawyers thereby changing their primary MOS. Participation in FLEP or ELP-L ultimately changes the career path of an officer in addition to granting a graduate level degree. Utilization of officers in these programs is very specific and restricted to only Judge Advocate General

(JAG) billets. Career and promotion potential for officers in FLEP or ELP-L are not subject to the same perceptions that may impact other PME or Non-PME graduate programs with respect to individual or organizational benefit. Graduates of these programs satisfy a requirement for lawyers during the remainder of their careers unlike PME graduates who continue to serve in their primary MOS or other Non-PME graduates who fill a specific billet and then return to their primary MOS.

There is an inherent expectation that an education program, regardless of its focus, will provide some benefit to both the individual and the organization. The benefits to an individual may be in the form of self-improvement and the potential for future monetary return. Similarly for the organization, the benefit of education may be reflected in increased productivity or proficiency of its employees. The difficulty for the Marine Corps in maintaining a wide spectrum of graduate education programs lies in accurately assessing the performance (productivity) benefit that it realizes from each. For individual Marine officers the difficulty lies in choosing the graduate program that offers the greatest benefit with respect to self-improvement and potential reward. Failure to make an accurate assessment by either party can result in a misallocation of resources or an emphasis on one program over another based on cultural perceptions rather than on empirical evidence.

B. PURPOSE OF STUDY

This research examines the effect of Marine Corps graduate education programs, both PME and Non-PME, on officer performance. The purpose is to explore and identify any difference in officer performance that may be attributed to either graduate program. This study analyzes the impact of each graduate program utilizing a common measure of officer performance derived from the Marine Corps Performance Evaluation System (PES). The objective of the analysis is to assess the return to the Marine Corps from its graduate education programs via their effect on officer productivity. The study attempts to provide information that will be useful to policy makers and Marine officers in assessing the value of all Marine Corps graduate programs. This study provides an objective analysis of the effects of both types of graduate education (PME and Non-PME). It also attempts to examine the perception that PME graduate education is the most beneficial to officer performance.

Prior studies have attempted to describe the benefit of various graduate level education programs through examination of historical data on promotion rates, retention rates, and the probability of achieving positions of operational command. A weakness of these studies is that using a proxy for performance, such as promotion or retention rates interjects the effects of other factors that may be unrelated to education and performance. For example, retention and promotion are both affected by MOS shortages, force shaping by the organization and self-selection. Additionally, prior studies have used historical performance data from before 1999. In 1998 the Marine Corps introduced a new fitness report as part of the PES. The new report was intended to alleviate the inflated performance grades that had existed in the fitness report system, and give a more accurate assessment of every officer's performance. Using fitness report data prior to 1999 as the dependent variable in some of the previous studies may have provided less reliable estimates of the effect of graduate education due to the inflation of fitness report grades and low variability across individuals

This study differs from earlier works in that the officer performance will be measured by a Performance Index (PI) derived from the Marine Corps' PES. By using a PI we hope to limit the effects of factors that are unrelated to education or performance. Also, the data on which this analysis is based will include performance grades of the new fitness report adopted by the Marine Corps in 1999, which should provide greater variation across individuals and thus a more accurate indicator of performance.

C. ORGANIZATION OF STUDY

This thesis first describes the two populations of officers that have participated in graduate education via either PME or Non-PME. Then, a thorough description of the measure of performance, the PES, is presented. After analyzing historical performance data and other pertinent officer attributes we specify models to predict the effects of graduate education and to compare the effects of PME and Non-PME graduate education. Finally, we use our results to draw conclusions and make recommendations on how the Marine Corps may better allocate resources to the different graduate programs in order to maximize benefits.

Chapter II is a literature review of prior studies. Literature relevant to labor market economics and the results of prior studies are reviewed to assist in the selection of the variables for our predictive models. Chapter III consists of an in-depth description of the policies, directives and perceptions that surround PME and Non-PME officer education in the Marine Corps. It establishes a basis for comparison of both categories of education through an objective evaluation of program similarities and differences. Chapter IV describes the current policies and procedures that govern the Marine Corps' Performance Evaluation System. This chapter also establishes the validity of using a PI derived from the PES and details the derivation of the PI. Chapters V and VI present our empirical methodology, model specification, and discusses the data and results. Chapter VII brings together the results of our analysis, points out strengths and limitations, and draws conclusions about the performance effects of PME and Non-PME graduate education. Chapter VII also presents recommendations on how to utilize the methodology and findings of this study to assess the value of Marine Corps graduate education programs in the future.

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II. LITERATURE REVIEW

A. THE ECONOMICS OF EDUCATION

The effect of graduate education on job performance is examined in labor economics literature. The theories of human capital and signaling theory are recurring topics in economic analyses. The two theories support varying views on the economics of graduate education. Additionally, labor economics highlights the difficulty of conducting quantitative research on the returns to graduate education. The difficulties are in measuring productivity and the role of selection bias in quantifying the returns to graduate education. A discussion of human capital theory, signaling theory, and the difficulties of studying the impact of graduate education on job performance provide a foundation for a further review of literature directly related to the research question.

Human capital theory asserts that graduate education is an investment in individuals that has similar attributes to traditional physical capital investments. Within the framework of human capital theory graduate education can be analyzed in the same way as any other investment. Just as firms and individuals weigh specific costs and seek specific benefits in making financial investments, human capital theory assumes that the same weighing of costs and benefits characterizes the behavior of firms and individuals when investing in graduate education. “As with any other investment, an investment in human capital entails costs that are borne in the near term with the expectation that benefits will accrue in the future.” (Ehrenberg and Smith, 2000).

In this study the firm is the United States Marine Corps. The near term costs to the Marine Corps of investing in graduate education include the fiscal funding for graduate education programs and the opportunity costs of assigning an officer to an educational billet rather than to an operational billet. The expected benefit to the Marine Corps of the graduate education investment is improved future on-the-job performance. The Marine Corps seeks a return on its investment primarily through assigning the graduates of its fully funded graduate programs to subspecialty or staff utilization tours. The near-term costs to the officer include the psychic costs of arduous study and the opportunity cost of foregoing an operational billet. For the officer, “the expected returns

are in the form of higher future earnings, increased job satisfaction over one's lifetime, and a greater appreciation of nonmarket activities and interests.”(Ehrenberg and Smith, 2000). Because the Marine Corps is a closed labor market with a fixed pay scale dependent on only rank and time in service, the expected return of higher future earnings attributed to improved performance cannot be realized while in active service. Rather, higher probability of promotion during active service is one of the expected benefits for officers who undertake graduate education. The post-service benefits for officers include higher earnings and enhanced employment opportunities in the civilian sector. Thus, the Marine Corps' decision to provide funded graduate education and the officer's decision to participate in graduate education can be modeled as economic decisions. If the discounted future benefits of increased on-the-job performance by officers who attend graduate education exceed the near term costs of such programs, the Marine Corps should invest in graduate education. If not, the Marine Corps should not invest in graduate education. Likewise, if the discounted expected future benefits realized by the increased probability of promotion and other outcomes exceed the near terms costs of undertaking advanced learning, the officer should also invest in graduate education. If not, the officer should not invest in graduate education. It should be noted that, unlike the civilian sector, the Marine Corps subsidizes most of the officer's direct costs of investment in education.

Signaling theory views the role of graduate education in labor economics in a different way than human capital theory. The signaling model asserts that employers use formal schooling such as graduate education as a screening device. Employers seek to identify the most productive workers. By successfully screening out less productive workers a firm can hire, terminate, and compensate based on the productivity of its employees. Signaling theory states that the decision of an individual to seek or not to seek formal education is a signal of the true productivity of the individual. This behavior is known as “educational signaling”.(Ehrenberg and Smith, 2000). If those who acquire education tend to have personal characteristics such as greater motivation, discipline, and commitment that are correlated with higher productivity, then undertaking graduate school is a signal of a productive individual. It must be noted that, from the signaling theory viewpoint, advanced education does not necessarily improve worker productivity.

With respect to the Marine Corps and its officers, signaling theory implies that officers who participate in graduate programs send a signal that identifies them as productive officers. Additionally, under the signaling theory an employer will not be willing to pay for a graduate degree unless it is less costly than using some other means (e.g., testing) to identify the most productive workers. The value of graduate education as illustrated by the signaling model is thus different from the human capital model. In the former, the utility of advanced education to the Marine Corps and the officer is identifying those who are most productive. In the latter, the utility of advanced education is an investment with the expected return of increased job productivity in the future.

Whether analyzed through the human capital model or the signaling model, research on the returns to graduate education is complicated by the difficulty of quantifying the non-monetary costs and benefits of education and adjusting for the role of selection bias. As noted earlier, the decision by the employer and the employee to undertake advanced education is determined by comparing near term costs to expected future benefits. The two widely accepted rules for conducting such analysis are the present value rule and the internal rate of return rule. Applying these rules requires quantifying both pecuniary and non-pecuniary costs and benefits. Quantifying pecuniary aspects such as direct program costs and foregone earnings is elementary, but psychic costs and benefits are not as easily captured. Critics of research that strives to explain the returns to graduate education argue that without quantifying non-pecuniary aspects any such analysis is incomplete. Additionally, it is argued that the lack of accurate and standardized methods to measure worker productivity prevents researchers from analyzing the primary benefit to firms of educational investments.

Further complicating research in this area, labor economists add “there are potential biases in the estimated rate of return to education. These biases, which are of unknown size, work in opposite directions.”(Ehrenberg and Smith, 2000). The biases are ability bias and self-selection bias. Ability bias causes the return on graduate education to be overstated. The human capital model assumes that the expected future benefit of increased on-the-job performance is attributed in whole to the performance-enhancing effect of education. The role of ability bias is “people who are smarter and more dynamic are likely to obtain more schooling and might be more productive even if they

did not complete more years of schooling.” (Ehrenbergh and Smith, 2000). Therefore, not taking into account the innate abilities of individuals who acquire graduate education overstates the performance benefit of advanced education.

Self-selection bias causes the return to education to be either overstated or understated. In natural experiments the premise of randomness amongst treatment and control groups must be maintained to assure unbiased results. In observational studies self-selection bias is the tendency for individuals to choose or abstain from participating in activities, such as graduate education, depending on their aptitudes. Those who are academically talented or enjoy academia will self-select into graduate programs, whereas those who are mechanically talented or enjoy non-academic activities may not participate. Thus, depending on one’s aptitudes towards education, self-selection bias can cause the returns to graduate education to be mis-stated. Self-selection bias also introduces non-randomness into empirical analysis. The premise of randomness in inferential statistics must be maintained to ensure unbiased and consistent results.

B. REVIEW OF PREVIOUS STUDIES OF PME/NON-PME AND PERFORMANCE

Studies on the return to graduate education are extensive. However, research that specifically examines the effect of graduate education on the performance of Marine officers is less common. The studies selected for review are chosen to present the latest work on graduate education and officer performance and to build a framework for understanding the methods employed in this research. Branigan’s (2001) Master’s thesis, “The Effect of Graduate Education on the Retention and Promotion of Marine Corps Officers” is the latest study on the research question. Branigan summarizes all of the related studies prior to 2001. Branigan’s primary contribution to this research is his summary of prior work. Branigan’s summary includes Cymrot’s (1986) “Graduate Education and the Promotion of Officers,” Bowman and Mehay’s (1999) “Graduate education and employee performance: evidence from military personnel,” Long’s (1992) “Effect of Variables Independent of Performance on Promotion Rates to Major, Lieutenant Colonel, and Colonel in the Marine Corps,” and Estridge’s (1995) “A Comparative Analysis of Promotion Probabilities For Marine Corps Field Grade Officers With Special Attention Given to Graduates of the Naval Postgraduate School.” Two

doctoral dissertations are most pertinent to this study. Roush's (1972) dissertation "A Study of the Effects of Participation by Marine Corps Officers in the Special Education Program on their Military Performance Ratings" provides insight into the effect of traditional graduate studies on officer performance, while Lloyd's (1977) dissertation "A Study of the Effects of Attending an Amphibious Warfare Course Upon the Postgraduate Performance of Military Duties by U.S. Marine Corps Officers" provides insight into the effect of PME on officer performance. Together, Roush's and Lloyd's research serve as a complete framework for describing this study's econometric analysis.

1. Study by Cymrot (1986)

Cymrot's (1986) "Graduate Education and the Promotion of Officers," study asserts that performance evaluations, promotion and retention are valid indicators of productivity in the military. The author goes further to propose that promotion to higher levels of responsibility and pay is the primary indicator of productivity in the military. Cymrot's principle relationship of interest is the effect of fully funded graduate education on the promotion of Navy officers. The cross sectional data used are from the 1985 Officer Master File. All officers from the ranks of O4 through O7 are used in the study. Cymrot hypothesizes that an officer who is selected for promotion ahead of his accession cohort has demonstrated outstanding performance. The author recognizes that selection for fully funded graduate education is contingent upon potential for promotion to the next rank, thus introducing selection bias into the analysis. Cymrot does not attempt to correct for selection bias. Because of selection bias the impact of graduate education on promotion cannot be totally attributed to advanced education and may be overstated. Cymrot uses a logistic regression (LOGIT) model to explain the impact of graduate education and other officer traits on the probability of promotion. In addition to participation in graduate education, the author includes explanatory variables for age, sex, race, and time in grade for previous ranks, continuous active service and branch designation.

Cymrot's results reveal that graduate education is statistically significant in explaining promotion to the ranks of O4, O5, and O6, but not to O7. Officers who complete graduate education are more likely to be promoted than officers who do not. Having a graduate degree increases the probability of promotion to O4 by 26 percent and

to O5 by 10.5 percent. Cymrot notes that his conclusions are weakened by self-selection bias and sample selection bias.

2. Study by Bowman and Mehay (1999)

Bowman and Mehay (1999) attempt to correct for the role of selection bias in their study “Graduate education and employee performance: evidence from military personnel.” Understanding that the self-selection that an individual exercises and the Navy’s selection of competitive-for-promotion individuals into advanced education may bias upward the marginal effect of graduate education on performance, the authors use models and techniques aimed at eliminating these effects. Like Cymrot, Bowman and Mehay use promotion as a proxy for individual performance. The study uses data from the Navy’s Promotion History File merged with fitness report data for all Navy line and staff officers considered for promotion to O4 between 1985 and 1990. The authors group explanatory variables into cognitive traits, affective traits and demographic traits: Cognitive traits include college GPA, type of undergraduate degree, and graduate education; Affective background attributes include the officer’s accession program; and Demographic traits include race, gender, and marital status. Bowman and Mehay hypothesize that graduate education is positively related to the probability of promotion to O4.

The authors first use a sequential modeling process. They utilize a single stage probit technique in their first four models. Each succeeding model increases the number of controls in the model to isolate the effect of graduate education on promotion and to control for variables that may capture the selection process. The first model includes only demographic traits and graduate education. The second model adds cognitive traits and, while the third model adds affective traits.

The results indicate that as additional variables are included the marginal effect of graduate education on the probability of promotion decreases approximately 40 percent, from .980 to .065 and from .145 to .089, for line and staff officers respectively. The authors continue to isolate the impact of graduate education by eliminating the unobserved factors that relate both to self-selection bias and competitiveness for promotion. They use bivariate probit analysis and instrumental variables to eliminate

these biases. The results of the bivariate probit analysis indicate that an officer with graduate education is .045 to .056 (for line and staff, respectively) more likely to be promoted to O4 than officers without graduate education. The strengths of Bowman and Mehay's research are the correct identification of cognitive, affective, and demographic explanatory variables, the use of individual officer fitness report data, and the elimination of selection bias. Although the authors complete a noteworthy analysis, Bowman and Mehay's results may be weakened by using promotion as a proxy for performance

3. Study by Long (1992)

In Long's (1992) master's thesis "Effect of Variables Independent of Performance of Promotion Rates to Major, Lieutenant Colonel, and Colonel in the Marine Corps," professional military education is introduced as an explanatory variable. PME is measured as a binary variable indicating the completion of appropriate level professional military education. The author uses cross sectional data on officers in-zone for promotion to the ranks of O4 through O6 for FY 1986 through FY1982. Long uses the LOGIT function to model the marginal impact of selected explanatory variables on the probability of promotion to each respective rank. He hypothesizes that the completion of PME and having a graduate degree make promotion to the next rank more likely than not completing PME or not having a graduate degree. Long's results indicate that the officer who completes PME is more likely to be promoted than an officer who does not. Long's findings concur with Cymrot's and Bowman and Mehay's that an officer who completes graduate education is more likely to be promoted.

4. Study by Estridge (1995)

In his masters thesis "A Comparative Analysis of Promotion Probabilities For Marine Corps Field Grade Officers With Special Attention Given to the Graduates of The Naval Postgraduate School," Estridge (1995) introduces a different technique than that used by Cymrot, Bowman and Mehay, and Long. Estridge does, however, continue using promotion as a dependent variable to capture individual officer performance. Estridge uses data from the 1993 and 1994 promotion boards to O4 and O5. His variable of interest is graduate education, specifically officers who attended NPS. Other explanatory variables include accession source, MOS, number of personal awards, race, gender, and a

“performance index.” Estridge’s use of the performance index (PI) distinguishes his work from that of the other researchers.

Estridge develops a PI by first assigning values to each of the 21 individual performance attributes of the PES. The mean values of all observed marks of the performance attributes are added together to form the performance index. The resulting PI indicates hyper-inflation of fitness report remarks. The value of PI ranges from 1 to 12. The mean PI for O3’s is 11.78, and the mean PI for O5’s is 11.66, indicating grade inflation. Despite the lack of variation in PI across the sample, the performance index proved to have the greatest effect of any variable in Estridge’s model explaining the probability of promotion. This result confirmed his hypothesis that promotion probability varies directly with PI. Additionally, Estridge’s results concur with other researchers who have found that graduate education positively impacts the chances of promotion. The primary significance of Estridge’s research is the finding that individual officer fitness report scores in the form of a performance index is a statistically and practically significant variable in explaining performance.

5. Study by Roush (1972)

Roush’s (1972) dissertation “A Study of the Effects of Participation by Marine Corps Officers in the Special Education Program on Their Military Performance Ratings” introduces the key econometric methodologies used in this thesis. Roush’s work is the earliest attempt to examine the relationship between graduate education and Marine officer performance. The author’s statement of the problem is: “the problem was to study and to interpret the effect of participation by Marine Corps officers in the Special Education Program on their subsequent performance ratings.” (Roush, 1972). He notes that the impetus for his work was the unsubstantiated, yet optimistic institutional belief that advanced education translates into improved performance in the Marine Corps. Roush’s hypotheses include “that military performance ratings for Marine Corps officers subsequent to their participation in the Special Education Program differed from military performance ratings of officers not participating in the program.” (Roush, 1972). The data were collected on the 283 officers who participated in or were alternates for SEP during the period 1963 through 1968. The source of data was the Officer’s Selection

Board Jacket. Roush was able to extract military performance ratings for the period in question and all data needed to develop selected explanatory variables from this file.

The author separates the sample of officers into experimental and control groups. The experimental group receives treatment, while the control group does not receive treatment. Roush's control group consists of SEP alternates who did not attend NPS. His experimental group consists of officers who attended NPS. The treatment in the experiment is completing SEP. Roush's primary relationship of interest is the effect of completing graduate education on the post-treatment performance of attendees.

In order to model this relationship, the author uses officer fitness report markings from the PES to represent individual performance. Roush uses item 19 of section C to represent performance.

This item purports to be an estimate of the individual's overall value to the service. The evaluation is made with the reference to the rating officer's estimates of the overall value to the service of all the officers of the same rank whose professional abilities are known to him personally. (Roush, 1972).

Thus, item 19 served as a single comprehensive metric to capture officer performance. The author admits that inconsistencies with the PES, if not corrected, would weaken his analysis. These inconsistencies were hyperinflation of marks by Rating Officers and grade inflation attributed to increasing rank. Roush recognized the endemic problem of Rating Officers grading most subordinates as "outstanding" in item 19, which reduced variation. Additionally, Roush recognized the trend of increased inflation of remarks as rank increased. To correct for hyperinflation Roush put considerable effort into converting all performance data into normalized T-scores.

...the item 19 marking on each fitness report was assigned a T-score, dependent not only on the mark itself, but also on the rank of the officer being rated and the time period in which the marking was assigned...scores were then weighted according to the number of months [observed]...results were expressed as an average T-score per unit of time first from 1960 until selected as a participant or an alternate and again , during the period after participation or selection as an alternate until 1971. (Roush, 1972).

By normalizing item 19 markings, Roush asserted that his performance variable was a consistent, unbiased indicator of officer performance before and after the treatment of graduate school.

Roush analyzes the data using two different methods. First, he uses analysis of covariance single stage classification (ANOVA) technique. Next, he uses multivariate regression analysis. Roush uses ANOVA to determine the statistical difference in performance ratings of the control group and experimental group subsequent to selection and non-attendance in SEP or selection and attendance in SEP. Subsequent military performance ratings (post treatment fitness report scores) is the criterion variable. The criterion variable is analyzed with respect to three control variables: fitness report scores before participation in graduate school or selection as an alternate (pre-treatment fitness report scores), General Classification Test (GCT) scores, and undergraduate grade point average (GPA) scores. Roush uses multivariate regression to determine if the criterion variable, subsequent military performance rating is significantly related to five independent predictor variables. Roush's a priori hypothesis was that military performance ratings following participation in SEP could be explained by pre-treatment fitness report scores, GCT scores, undergraduate GPA, SEP GPA, and Basic School class standing.

Roush attains mixed results. The ANOVA did not support his hypothesis that subsequent military performance ratings of SEP graduates and SEP alternates who did not attend graduate school were different. The ANOVA revealed that the difference in ratings is statistically insignificant. Thus, Roush's analysis shows there is no performance difference between officers who attend graduate school and those who do not. The results of the multivariate regression reveals undergraduate GPA, SEP GPA, and Basic School class standing are significant predictors. GCT scores are not significant predictors of performance.

This study borrows from the strengths of Roush's analytical methodology. This research repeats Roush's use of longitudinal performance data in the form of fitness report markings as the measure of officer performance. Additionally, the practice of using control groups, treatment groups, and (post- and pre-) treatment effects is

continued. We also repeat Roush's procedure of conducting t-tests for difference in means and using the ANOVA to identify differences in performance between treatment and control groups. Roush's considerable effort to eliminate fitness report inflation is the primary reason for using the new Marine Corps fitness report that was introduced in 1999.

6. Study by Lloyd (1977)

Lloyd (1977) continued Roush's work. Lloyd was directed by the Marine Corps Manpower Management command to determine the impact of attending Amphibious Warfare School (AWS), a PME school, on officer performance. Lloyd's research was identical to Roush's, but his primary relationship of interest was the impact of AWS on subsequent fitness report markings in regular and utilization duties. Lloyd differentiated regular duties as billets that were not specific utilization billets for graduates of the AWS course. Lloyd's findings indicate that graduates of the AWS had course subsequent military markings that were no different from non-graduates in the performance of regular duties. However, Lloyd also finds that graduates of the AWS course attain higher fitness report markings when assigned in utilization tours. The strength of Lloyd's work is the correction of fitness report inflation and the analysis of performance across both regular and utilization tours. Lloyd's finding that graduates of PME courses perform no differently than non-graduates in regular duties, and better than non-graduates in utilization tours, is significant to this study.

C. CHAPTER SUMMARY

This chapter reviewed prior studies that are relevant to this study. In particular, the methodology of Roush (1972), which uses longitudinal performance data and the classification of treatment groups, is used as the framework for our statistical analysis. Additionally, former studies by Bowman and Mehay (1999), Estridge (1995) and Branigan (2001) provide insight into what variables other than graduate education should be included in multivariate performance models and should be used to address selection bias. The literature review identifies the strengths of the previous studies for use in our methodology and model specification described in Chapters V and VI.

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III. PME AND NON-PME GRADUATE EDUCATION

This thesis compares two populations of Marine officers in order to examine the performance effects of graduate level education programs. We simplify the comparison during our quantitative analysis (Chapter V and VI) by categorizing like programs and their graduates into one of two categories, PME and Non-PME. This chapter constructs the framework for our categorization of the various Marine Corps graduate programs. The framework enables us to compare PME to Non-PME graduate education. In placing officer educational programs into these two categories, some programs were omitted to insure that only those programs with similar levels of education, educational objectives, or utility to the Marine Corps and individual officer are included in the comparative analysis. Additionally, programs that are placed in either category must not overlap so that we can accurately determine the causal effect of each. The following is a description of Marine Corps graduate programs, their purpose and structure, and their categorization as either PME or Non-PME.

A. PROFESSIONAL MILITARY EDUCATION (PME)

The beginnings of formal Professional Military Education (PME) programs in the Marine Corps can be traced back to 1891 when the School of Application was established at the Marine Barracks, Washington D.C. During that time the purpose of formalized education for Marine officers was to accomplish little more than provide knowledge for young officers to perform their basic duties. Through the end of World War I the structure of officer PME remained unchanged but it was also being used to combat the boredom and discipline problems that accompanied the post-war demobilization. Under the guidance of Commandant of the Marine Corps, Major General John A. Lejeune, officer PME was more clearly focused toward the establishment of a "permanent and progressive system of professional military education for its [the Marine Corps'] officer personnel." (MCU History, MCUonline, <http://www.mcu.usmc.mil/mcu/History/about.htm>). In the fall of 1919 the Marine Corps' vocational schools opened, establishing a new structure and purpose for what would later become the Marine Corps University. Today MCU encompasses all officer PME schools and programs.

PME includes schools and programs that follow a progression aimed at providing an officer "the skills, confidence, understanding, and vision to exercise sound military judgment and decision making in battle". (PME Order, MCO P1553.4, Dec 1999). Schools become available to officers at specific career points, normally in conjunction with promotion, where a higher level of military education is required. The structure of officer PME follows five levels of military education as defined by the Joint Chiefs of Staff (CJCSI 1800.01A, Dec 2000): precommissioning, primary/career, intermediate, senior and general level. At each level PME provides the knowledge and initiates the level of analytical thinking necessary to perform the duties and responsibilities of officers at that level. In order to understand comparisons made later in this thesis between selected PME and Non-PME programs, it important to first understand why some are considered graduate level education and others are not.

1. Precommissioning Level PME

At the precommissioning level the focus of PME is to provide a basic understanding of the history and culture of the Marine Corps. Familiarization with the levels of war and the Marine Corps' role in each is all that is required for precommissioning education. The main purpose of PME at this level is to introduce the culture and doctrine of the Marine Corps to prospective officers in an effort to reinforce their interest in becoming Marines. At this point in a Marine's career, training in fundamental tasks and duties plays a larger role than the creative and analytical abilities developed through PME.

PME at the precommissioning level involves only prospective Marine officers; that is, candidates who are still participating in indoctrination-training programs and have not yet been commissioned in the Marine Corps. Programs such as the United States Naval Academy (USNA), the Marine Corps' Officer Candidate School (OCS), and Reserve Officer Training Corps (ROTC) provide this level of PME. PME at this career point can be considered baccalaureate level education as the institutions and programs that provide it are undergraduate programs or available only to undergraduate students. In this thesis, precommissioning PME will not be examined. First, PME at this level is at the undergraduate level and therefore it would be inappropriate to make such a comparison to Non-PME graduate programs. Second, the entire population of Marine

officers has participated in some type of precommissioning PME hence no comparisons can be made.

2. Primary/Career Level PME

The second level of military education is the primary/career level. It is at this level that PME is expanded to provide Marine officers with the educational tools to assume leadership roles and responsibilities, perform duties in their MOS, and contribute to the combat capability of the Marine Corps. The objectives of primary/career level PME are to enhance decision-making ability, develop awareness of joint warfighting, improve management and communication skills, and improve proficiency in military specialties. (MCO P1553.4, Dec 1999). Similar to PME at the precommissioning level, the scope of PME is specific to the educational needs of the military culture and remains primarily at a baccalaureate level. The difference is that PME programs at the primary/career level are provided only in military institutions and not in civilian universities.

The Marine Corps institutions that provide primary/career level PME are typically schools that Marine officers attend in the first four years of commissioned service and provide knowledge required for the ranks of Second Lieutenant to Captain. The Basic School (TBS) provides the first of these courses. At TBS the course is "a 6 month, primary level course that all second lieutenants attend after commissioning." (MCO P1553.4, Dec 1999). It is during TBS that officers learn the intricacies of the Marine Corps culture and the accepted norms in leadership practices, professional demeanor and the basics of infantry tactics and weapons systems and their application in maneuver warfare doctrine.

Amphibious Warfare School is the second opportunity for PME for officers in the primary/career level. AWS is a career level school that provides curriculum in residence or through distance education program (DEP) that is, correspondence courses. There is no difference in the level of education gained through either resident or non-resident AWS; however, the difference between the two is explained later in this chapter. Participants of AWS resident or distance education program (DEP) are typically senior First Lieutenants or Captains who have completed an initial tour of duty in an operational

billet but do not yet have the rank, knowledge or experience to assume intermediate or senior level staff positions or responsibilities. The objective of AWS is to "provide and develop skills, knowledge and judgment needed to operate effectively on a Marine Air/Ground Task Force (MAGTF) staff or in a command billet as a captain or major." (MCO P1553.4, Dec 1999). AWS develops a detailed understanding of war fighting theory and skills as well as Marine Corps doctrine on use of a MAGTF. An intended outcome of AWS is to sharpen the abilities of mid-grade officers to perform assigned duties during combat operations at the tactical level of war. Although the AWS provides more in depth education on Marine Corps doctrine than TBS, it is not considered graduate level education. There is no accreditation of a graduate degree or equivalent certification given to graduates of AWS, whether resident or non-resident.

Within the Marine Corps University, AWS is a school independent of other PME schools at the primary/career level of military education. The resident program resides in Quantico, Virginia and is a nine-month school that convenes once a year. During a school year AWS graduates approximately 150 Marine officers who are typically between the rank of First Lieutenant and Captain. A limited number of officers can attend resident AWS and that number varies from year to year. An officer must specifically request to attend resident AWS. Officers who choose not to attend AWS resident may complete AWS through the DEP, which consists of a series of correspondences courses that mirror the resident school's curriculum. Officers participating in non-resident AWS are not required to finish the course in the same amount of time as the resident students. They are, however, encouraged to complete the non-resident course prior to becoming eligible for promotion to major.

Unlike precommissioning or primary level PME, participation in AWS is not an absolute requirement for Marine officers. Continuation of PME beyond the precommissioning and primary level is strongly encouraged and considered a distinguishing trait in officers who are eligible for promotion. Because completion of PME at the career level can be used as a discriminator by promotion boards, the completion of AWS (resident or non-resident) has emerged in the culture of the Marine Corps as a de facto requirement for promotion to the rank of major. Law in United States Code, Title 10, however, sets only the absolute minimum requirements. The perception

by the officer community that career level PME is a requirement for promotion has made participation in AWS the common choice; however, it is, in fact, voluntary.

3. Intermediate Level PME

It is at the intermediate level that Marine officer PME schools are first considered to be graduate level education. At this level the focus of PME is to develop a greater understanding of "employment of larger military units at the operational level of war... other service [Army, Navy, Air Force] capabilities, limitations, and doctrines." Here PME departs from the career level as the "emphasis shifts from skill training to developing an officer's analytic abilities and critical thinking skills." (MCO P1553.4, Dec 1999). The goal of intermediate PME is to prepare officers for higher-level staff and command positions. Similar to graduate education at civilian universities, intermediate PME develops cognitive skills and promotes innovative thought and decision-making skills.

The Marine Corps' single intermediate level PME School is the Command and Staff College located in Quantico, Virginia. Officers may choose to attend equivalent PME schools administered by other services, which are included in the data. This study focuses only on those operated by the Marine Corps. The CSC operates two separate courses, which are the Command and Staff course and the School of Advanced Warfighting course. The CSC is operated similarly to AWS in that it has a resident and non-resident program. The non-resident correspondence option is only available for the Command and Staff course not for SAW. Participation in CSC is voluntary but strongly encouraged for Marine majors who are eligible for promotion to lieutenant colonel. CSC is also available to officers from other services, international officers and civilian DoD employees. Marine captains and lieutenants may participate in the non-resident Command and Staff course provided a waiver is attained from MCU and PME at the career level has been completed, however, this is not part of the normal career progression for captains and lieutenants. The result is small representation of these ranks at this level of PME.

The Command and Staff resident course is a ten-month program that convenes once a year and graduates approximately 100 Marine officers. Officers who participate

in this course gain a greater understanding of MAGTF operations at the operational level of war as well as the employment of MAGTFs in joint and multinational operations. Command and Staff offers incentive for voluntary participation by increasing an officer's human capital through education. The potential benefit is promotion beyond major and command opportunities; as with AWS, officers at the intermediate level view participation as a de facto requirement for promotion beyond the rank of major. The CSC's intent is to "offer a curriculum of graduate level rigor to educate officers in the relationships between...operational and tactical levels of war." (CSC mission, MCUonline, <http://www.mcu.usmc.mil/csc/purpose.htm>). The non-resident course mirrors the resident curriculum thereby providing the same human capital-enhancing incentive for participation. While the Marine Corps considers the Command and Staff course graduate level education, there is no formal accreditation of a graduate degree for either the resident or non-resident programs.

The School of Advanced Warfighting course differs from the Command and Staff course in that it is only available in residence at CSC. Students who attend this 11-month course are selected from officer applicants who have already completed the Command and Staff course (resident or non-resident). Up to 15 Marine officers may attend SAW each year. The purpose of SAW is to provide graduates of the Command and Staff course the opportunity to explore the link between the planning and conduct of war by analyzing historical cases.

The educational objective of SAW is to sharpen analytical and decision-making skills. That objective is met by allowing SAW students to participate in a course of instruction that focuses on research techniques; analysis and problem solving that will later be used in the writing of a final paper similar to a Master's thesis. Also, through open forum discussions students are offered the opportunity to speak about selected topics on military campaigns. The result of participation in the SAW is the development of Marine officers who are able to research, analyze and communicate findings on war fighting issues making them better suited to serve in high level Marine Corps, joint or multinational staff positions. Graduates of the SAW course are also conferred a Master's degree in Military Studies accredited by the Southern Association of Colleges and Schools, Commission on Colleges.

Because participation in SAW results in the attainment of an accredited Master's degree it is one of two PME programs that is most similar to a Non-PME graduate school. However, for the purpose of making a comparison on the performance effects of PME graduate programs, the population of SAW is far too small for any credible argument to be based. For the purpose of our comparative study, the Command and Staff course and the School of Advanced Warfighting are similar in many respects and therefore are both classified as graduate level PME. Both courses reside under the Command and Staff College as intermediate level PME schools and share the same mission and intent. By combining the population of officers who have graduated from the Command and Staff course, SAW and other service's intermediate level PME attended by Marine officers, we increase the sample we will use to analyze performance and strengthen the reliability of their results.

4. Senior Level PME

The Marine Corps War College (MCWAR) is the second of two PME programs that is considered to be graduate education. As a PME program MCWAR is classified at the senior level of PME. Although it offers a higher level of military education, with respect to degree accreditation it is equivalent to the level of education offered by CSC. The purpose of MCWAR is "to educate selected senior officers and civilians for decision-making during war and military operations other than war in a joint, interagency, and multinational environment."(MCWAR mission, MCUonline, <http://www.mcu.usmc.mil/mcwar/mission.htm>). The focus of the school is to provide senior officers the decision-making skills including the consideration of national military strategy, regional strategy, national security policies and objectives, and resources.

The Marine Corps operates MCWAR as its senior level PME school but allows Marine officers to attend equivalent level schools operated by the other services. MCWAR resides in Quantico, Virginia and selects senior officers, typically between the ranks of lieutenant colonel and colonel. The size of each class varies but is typically between ten and 15 students of which approximately six to seven are Marine officers. In contrast to intermediate level PME programs (i.e., Command and Staff and School of Advanced Warfighting) MCWAR confers a Master's degree in Strategic Studies to all graduates of the school. All participants in MCWAR complete a core curriculum and an

Independent Research Project similar to a Master's degree thesis. The Southern Association of Colleges and Schools, Commission on Colleges also accredits the MCWAR degree program. There is no non-resident option for completing MCWAR and hence the officer population that participates in the program is significantly smaller than the population in the intermediate and career level PME schools. Unlike the preceding levels of PME, MCWAR is not perceived as a de facto requirement for continued promotion and command opportunities; however, like any other PME school it is considered a desirable background that may be used as a discriminator at selection boards.

The Marine Corps War College is very similar to a traditional (i.e., non-military) graduate school in its methodology of teaching and the detail and scope of the subject matter it covers. For this reason, the population of officers who have attended MCWAR will be included in our comparison of PME programs with Non-PME graduate education programs. As stated earlier, MCWAR is a higher level of PME (i.e., senior level) compared to the CSC but it offers an equivalent level degree therefore it is reasonable to combine the two populations for the purpose of determining the effects of graduate level PME on officer performance. By combining Intermediate level and Senior level PME we again increase the size of our population, which lends to more reliable analysis of the performance effect of different types of education.

5. General Officer Level PME

The general officer level of PME is the highest level of military education that is available. The focus of PME at this level is on "the highest levels of strategy; integrating the components of national power to achieve national objectives." (MCO P1553.4, Dec 1999). The objectives of general officer PME are to provide venues for continued discussion and analysis of the strategic level of warfare drawing on the knowledge and experience of the general officers participating. PME at this level is considered at or above the Master's degree level; however, no formalized degree accreditation has been approved for PME schools/programs at the time of this thesis. Unlike intermediate and senior level PME in which participation is voluntary, participation in general officer PME is a requirement for those officers selected to general officer.

As stated above, this study focuses on the effects on performance of Marine Corps operated PME programs that are equivalent to a Master's degree. PME at the general officer level fails to meet these criteria for two reasons and therefore will not be considered in the empirical analysis (Chap. V). First, it is difficult to classify the level of education of general officer PME to a degree equivalent such as Baccalaureate, Master's, or Doctoral. In most instances, general officer PME, such as the CAPSTONE course conducted by the National Defense University, Joint Flag Officer Warfighting Course (JFOWC), Flag and General Officer Seminar on Joint Planning, and the Joint Force Air Component Commander (JFACC) Course, are simply forums for discussion and sharing of knowledge and experience on specific strategic level issues; they have no degree equivalency and their duration does not exceed six weeks. The second reason general officer PME will not be considered in our analysis is that of the existing PME programs, the Marine Corps operates none fully or in part. Marine general officers are selected to attend the aforementioned PME programs that are operated by different services or organizations within the Department of Defense.

6. Resident and Non-resident PME

As stated in Marine Corps Order 1553.4, the educational objectives of PME include developing "officers educated and skilled in the employment of forces and the conduct of war" and "strategic thinkers." In addition to the level of military education characterizing a PME program, the manner in which educational objectives are achieved presents a significant distinguishing characteristic of any PME program, whether it is resident or non-resident. For the purpose of this study we have constrained the population of officers to only two levels of PME. The levels chosen are the two that are considered to be graduate level education because they offer accredited Master's degrees; they are intermediate level PME represented by the Command and Staff College and senior level PME represented by the Marine Corps War College. Only the Command and Staff College offers its curriculum to officers through a non-resident, correspondence medium. Officers who have participated in the Command and Staff College, whether resident or non-resident, comprise more than three quarters of the population that participate in graduate level PME. It is therefore important to understand the distinction

between resident and non-resident PME and potential ramifications of either including or omitting the non-resident participants from our analysis.

The educational objectives of graduate level PME (CSC and MCWAR) are as stated above in subparagraphs 3 and 4. One manner in which goals are achieved is through a resident school program where selected officers receive transfer orders to either school. The nature of the orders presents an important difference between attending CSC or MCWAR and any other specialized training or school in that they are Permanent Change of Station (PCS) orders rather than Temporary Duty (TAD) orders. When an officer attends any specialized training or school where the duration is between 30 days and four months, an officer may receive TAD orders depending on the location of the school and whether travel away from his permanent duty station is required. At the completion of that school or training program the officer will return to his unit and continue serving in his original billet. Although that time spent at school will not be considered in the performance evaluation of his regular duties, it does not detract from it.

Before attending a resident PME school such as CSC or MCWAR where the duration is greater than six months an officer will receive PCS orders, which may require him to physically move from his current duty station location. That officer's performance is no longer being evaluated at his previous unit nor will he return to that unit after completing resident PME. During this time an officer's primary duty is to attend and successfully complete that PME school. This is an important distinction because the period of time that an officer spends in school is not evaluated in a fitness report. Periods of time not considered a part of an officer's performance evaluation are categorized as unobserved time. It is desirable to minimize the amount of unobserved time an officer attains as it may adversely impact his chances of future promotion or duty assignments. In the case of TAD orders to attend a school, the accrual of unobserved time may be offset by the ability to perform regular duties before and after completion of that school at the same unit. If an officer must leave his unit for resident PME and later go to a different unit there may not be continuity in the evaluation of his performance before and after he attended resident PME.

In addition to the receipt of PCS orders and the accrual of unobserved time when attending PME schools in residence, it is important to note that resident PME offers the opportunity to learn in a traditional classroom environment. The methodology of teaching in resident PME includes "reading, writing, research, oral presentations, seminar discussions, case studies, wargaming, practical application exercises, lectures and films; whichever most clearly and effectively conveys the material." (MCO P1553.4, Dec 1999). The benefit of resident PME lies not in its methodology but rather in that attendance is an officer's primary duty which alleviates the responsibilities of his previous operational billet and reduces distractions from the course of study.

A second means for an officer to attain PME is through a non-resident program, often referred to as distance education programs (DEP). The curricula for the non-resident PME programs "provide a baseline education that parallels the curriculum offered by the resident schools" for all levels of PME up to intermediate PME. (MCO P1553.4, Dec 1999). The non-resident or DEP for the Command and Staff College is administered by the Marine Corps Institute which is responsible for the distribution of course materials (i.e., books and tests) and the grading of tests and recording of scores and completion of PME courses. Although the curricula are equivalent to that of the resident school in scope and objectives, there are two primary differences between non-resident and resident PME. First, participation in non-resident PME does not require the receipt of transfer orders, either TAD or PCS, nor does it require an officer to leave his present duty location. Likewise, there is no accrual of unobserved time that may detract from an officer's record of performance, as he never leaves his current duty assignment. The completion of non-resident PME is achieved by the officer's individual efforts during off-duty hours allowing him to continue in his regular duties.

The second characteristic of non-resident PME is the lack of a traditional classroom environment. Non-resident PME does not provide a forum for discussions, the use of different media, an instructor or a focused atmosphere uninterrupted by the demands of either regular duty during working hours or personal matters during off-duty hours. Officers, on their own initiative, must read the course materials according to no set timeline and then take a test proctored by a senior officer at a time and location agreed upon by both. Because completion of non-resident PME is not an officer's primary duty,

the timeframe for completing non-resident CSC may be several weeks or years. The timetable for non-resident PME completion and the administration of tests are less rigid than at a resident PME school. This difference possibly reduces the quality of the education.

Efforts have been made by the Marine Corps University to provide better learning materials, instruction and forums for discussion through the DEP seminar program. The DEP seminar program provides a more structured timetable for completion of non-resident PME by providing weekly seminars that follow the curriculum and administer tests after a course section has been discussed. The seminar is led by a senior officer during off-duty hours, an attempt to replicate the classroom environment provided at resident PME schools. The DEP seminars, however, are strictly voluntary and enrollment does not require attendance at the weekly sessions or completion of the seminar program. Although great effort has been expended on making the DEP seminar a better learning environment, the same degree of focused study provided at resident PME schools can never be attained.

Because there is such a distinct difference in how PME is administered between resident and non-resident programs, it can be argued that the quality of education is different and therefore the effects on officer performance are different. That is a matter for further analysis that lies outside of the scope of this study. It does, however, affect our decision to exclude non-resident graduate PME from our study. For the purpose of this study our focus lies primarily on the levels of graduate education. We assume that education programs at the graduate level regardless of method of delivery, share the same educational objectives. However, to avoid deciding on the quality of various PME programs this study excludes non-resident PME from the PME category. Analysis of only resident PME and Non-PME graduate programs is conducted.

B. NON-PME GRADUATE EDUCATION

Section A. of this chapter described the different levels of PME and how they meet their educational objectives. In an effort to make a logical comparison between PME and Non-PME graduate education programs it is important to first understand the

composition, objectives and levels of Non-PME education programs and the ways in which they are similar to PME at the graduate level (i.e., CSC and MCWAR).

There are four categories of graduate education programs that the Marine Corps allows officers to attend. The Special Education Program, Advanced Degree Program, Law Education Program and Lifelong Learning all offer the opportunity to achieve a graduate degree. They are not part of the PME system of schools/programs and are not administered by the Marine Corps University or the Marine Corps Institute. Participants in these graduate programs comprise the population of Non-PME graduates, which will be compared to graduate-level PME schools. The purpose and structure of Non-PME programs are significantly different from PME programs primarily due to the lack of a single agency that oversees their administration. Of the Non-PME graduate programs none are operated exclusively by the Marine Corps or the Department of Defense. Although Non-PME programs are all considered graduate level education, unlike PME, they may not share the same method of instruction, curricula or intended utilization during an officer's career. Given the wide variation in the Non-PME education programs it is important to understand their similarities and differences.

1. Special Education Program

The Special Education Program (SEP) is comprised of two military operated schools and Marine Corps approved civilian schools. Participation in SEP is fully funded meaning that an officer continues to receive full pay and allowances and the Marine Corps pays all tuition and associated fees. The purpose of SEP is to educate Marine officers to serve in specialized staff positions "...which are required to be staffed by officers who possess postgraduate level education." (MCO 1520.9F, SEP Order, May 1993). Each year the Marine Corps establishes a quota for officers selected to attend Non-PME graduate education. Of that quota "Approximately three-fourths of the annual quota allocated for postgraduate education are assigned to the SEP." (MCO 1520.9F, SEP Order, May 1993). The remaining officers will attend either ADP or LEP. Officers selected for SEP each year may attend either the Naval Postgraduate School (NPS), the Air Force Institute of Technology (AFIT), or approved civilian universities.

NPS is a military graduate school operated by the Department of the Navy at Monterey, California. It is currently the Navy and Marine Corps' principle institution for educating officers at the graduate level. The Marine Corps does not operate NPS but as a major stakeholder in the level of education for Marine officers, provides funding to the school for research, reimbursement for Marine officer tuition and active duty instructors or lecturers.

The mission of NPS is to "provide relevant and innovative educational opportunities to Navy and Marine Corps Officers throughout their careers" and to increase "the combat effectiveness of the Navy and Marine Corps. It accomplishes this by providing post-baccalaureate degrees...in a variety of sub-specialty areas not available through other educational institutions." (NPS mission, NPS online catalog, <http://www.nps.navy.mil/ofcinst/intro-2.htm>). While broad in nature, the mission of NPS supports the Marine Corps' goal of educating Marines so they may serve in specific billets that require a graduate education. The intended outcome is officers with greater cognitive and analytical skills capable of sound decision-making.

NPS is strictly a resident program. Similar to resident PME, Marines receive PCS orders and their primary duty is to attend and complete NPS. During this time a Marine will accrue unobserved time in his performance record. Also similar to resident PME, NPS uses a methodology of instruction that incorporates a traditional classroom environment, lecture/seminar instruction lead by a Professor or military instructor and the most up-to-date presentation media. Completion of NPS results in Marine officers being conferred a Master's degree in one of 31, technical or non-technical disciplines. In stark contrast to graduate level PME, the degree disciplines are tailored toward military application but are not specifically military in nature. For example NPS confers Master's degrees in Aeronautical Engineering, Applied Mathematics, Computer Science, Contract Management, Systems Management as well as Meteorology; none of these are applicable exclusively to the military.

The Air Force Institute of Technology (AFIT) is the second military-operated school in the SEP. It is operated by the Air Force at Wright-Patterson Air Force Base, Dayton, Ohio. Marines who are selected to attend AFIT have their tuition and associated

educational fees fully funded by the Marine Corps. The Marine Corps also funds specific areas of research conducted at AFIT similar to NPS but to a much lesser extent.

The focus of AFIT is strictly technical in the curricula it offers to Marine students. Its mission and purpose, like NPS, support the Marine Corps' goal of educating officers for specific billets. Also similar to NPS, AFIT is a strictly resident school that Marines must receive PCS orders to attend. They also receive unobserved fitness reports. It uses a traditional classroom environment and lecture/seminar method of instruction in addition to laboratory sessions. Completion of AFIT results in a Master's degree in a technical discipline that specifically support a designated Marine Corps billet and like NPS, the degrees are specifically chosen for their applicability to Marine Corps operations but are not exclusively military in nature.

The final two programs in SEP allow Marine officers to attend civilian universities to attain a graduate degree. The reason for allowing a civilian education is that neither NPS nor AFIT provide degree programs in all disciplines the Marine Corps requires for its SEP staff billets. Per MCO 1520.9F, there are designated billets that must be filled by an officer with a graduate degree. SEP aligns the discipline of the degree with the specific needs of the billet. There are billets that require degrees in law and human resources management, neither of which is provided at NPS or AFIT. Officers selected to either the SEP(Law) or Human Resources Management (HRM) program may attend a civilian university of their choice subject to approval by Headquarters Marine Corps and admission requirements of that school. Once accepted to a civilian school, the Marine Corps will reimburse all tuition expenses and fees relevant to attainment of a Master's degree in these two disciplines. Officers participating in SEP(Law) or HRM receive PCS orders to a Marine Corps Detachment nearest the civilian school except in the event the school is in the local area of a Marine's current duty assignment. The SEP(Law) and HRM programs require that an officer attend a civilian school as his primary duty and that he enroll in the requisite amount of credit hours to maintain a full-time student status, hence these programs, like NPS and AFIT, are inherently resident. While studying at civilian schools officers also accrue unobserved time on their fitness report.

The focus of the SEP(Law) program is to produce officers who are skilled in specific areas of law in support of the Judge Advocate Corps. The specific areas of law which a SEP(Law) participant must concentrate his studies are: international law, environmental law, labor law, procurement law, criminal law and law (general). Officers are required to complete all LL.M degree requirements in one calendar year from the date the program commences.

The focus of the HRM program is to prepare officers to serve in billets at Marine Corps Family Service Centers. Officers participating in this program must also enroll in the required amount of credit hours to maintain a full-time student status. They must concentrate their studies toward the following areas: human development, management, family violence, public policy and government/community relations.

2. Advanced Degree Program

The Advanced Degree Program (ADP) provides another means for Marine officers to attain a graduate education by attending a civilian university. The ADP augments the number of SEP graduates each year insuring that the Marine Corps maintains a sufficient number of officers with graduate degrees to serve in specialized billets that require an officer with graduate level education in specific disciplines. The focus of curricula through ADP are outlined in Marine Corps Order 1560.19D and are, like SEP, not exclusively military related subjects but are determined to have specific applicability to the billets in which the officers will subsequently serve. ADP shares the same objective as SEP, however, it is classified as a completely different program because it is considered a partially-funded graduate program. Through ADP the Marine Corps continues an officer's regular pay and allowances and reimburses the cost of moving if PCS orders are issued. However, the individual Marine officer must pay all tuition and academic fees.

Officers who are selected to participate in ADP must meet the admission requirements of the civilian school they select. Attendance at any civilian university is restricted only to the extent that the degree attained must be in a discipline that allows him to serve in a specific billet. Although ADP is a partially-funded program, officers receive PCS orders requiring that attendance at the school be his primary duty; ADP is

considered a resident education program. Likewise, officers must maintain a full-time student status for the duration of the degree program, which may not extend beyond 24 months. Officers also accrue unobserved time on their subsequent fitness reports for the period of study during ADP. The intended outcome of ADP is officers with greater cognitive, analytical and decision-making skills who have achieved a Master's degree in selected technical and non-technical subjects that mirror those offered at NPS. The available subjects that an officer may be selected to attain a degree in will vary each year based on the needs of the Marine Corps.

3. Law Education Program

The Law Education Program (LEP) is comprised of two different programs, the Funded Law Education Program (FLEP) and the Extended Leave Program, Law ELP(L). Similar to SEP and ADP, the purpose of LEP is to provide the Marine Corps with graduate educated officers to serve in billets that require graduate degrees. Under LEP both law programs are partially funded because the individual officer pays the cost of tuition, fees and textbooks. LEP shares the same overall objective as SEP and ADP but is classified as a completely separate program under the Non-PME graduate education category. LEP is distinctly different because participants must attain a Master's degree in only one subject, law. LEP graduates attain a law degree to serve specifically as Marine lawyers as part of the Judge Advocate Corps. (LEGADMINMAN, MCO P5800.16A, Chap. 19). Unlike SEP/ADP where there are a variety of specialized billet a graduate may serve LEP does not offer a choice. Completion of LEP also results in a change to the officer's primary MOS to Marine Judge Advocate (4402). This is significantly different from the other Non-PME graduate programs. In the case of ADP/SEP, a subsequent tour of duty in a billet that utilizes the graduate degree is required. However, an officer may return to regular duty assignments in his primary MOS after his utilization tour and the remainder of his military service may follow the original career path. For LEP participants, officers do not return to duty assignments in their primary MOS, rather, 4402 becomes their primary MOS and the remainder of their service follows the normal career progression of a Marine lawyer. After the completion of LEP an officer's subsequent fitness report will accrued observed time in his new MOS.

The Funded Law Education Program (FLEP) is one of two programs that comprise the LEP. It is partially funded by the Marine Corps at a civilian school of the Marine officer's choice. The purpose of the program is to allow selected officers to attain a degree in law (LL.M) and change their primary MOS to that of Marine Lawyer. FLEP is a resident program and therefore officers must attend a civilian school full-time as their primary duty. Full pay and allowances are still granted for the duration of FLEP, but direct expenses are borne by the individual officer.

The Extended Leave Program (Law) is the second of two LEP graduate programs. It is also partially funded by the Marine Corps and a civilian school administers degree requirements. The difference in this program is that a Marine officer who is selected for this program is placed on extended leave and will not draw regular pay and allowances for the period he attends school. There is no reimbursement of any direct costs by the Marine Corps for ELP(L). Officers selected for ELP(L) may receive PCS orders if the school of choice is not in the local area of his present unit. If PCS orders are issued the costs associated with transferring location are reimbursed by the Marine Corps. Once travel is complete to the area of the school the officer is relieved of all military duties and commitments while on extended leave.

4. Lifelong Learning

The final Marine Corps program that may be categorized as Non-PME graduate education is the Lifelong Learning program (LLL). The mission of LLL is "to provide personal and professional learning opportunities to the Marine Corps community." (MCO 1560.25C). A secondary purpose of LLL is to act as a retention tool. In sharp contrast to the missions and objectives of the three other Non-PME graduate programs, LLL does not intend to produce officers with graduate degrees for service in a specific billet or unit. LLL is voluntary a program aimed at providing educational incentives for officers who seek further education as a means to retain them on active duty. Marines can finance the costs participating in LLL with Tuition Assistance (TA).

TA is available to officers as well as enlisted Marines. For officers TA may only be received for the attainment of Master's or Doctoral degrees. This program subsidizes the cost of tuition up to 75 percent for officers attending civilian graduate schools during

off-duty hours. Unlike ADP, SEP or LEP, participation in LLL and the receipt of TA is a non-resident program in that a Marine remains at his current duty assignment. Marine officers must attend graduate courses outside of their military work hours and therefore no unobserved time is accrued on fitness reports. No PCS or TAD orders are issued for participation in LLL and transfer of location to attend school is not authorized. Participating officers may select any graduate school in the local area of their current unit and study any available degree discipline offered by that institution. Participating in LLL and accepting TA obligates a Marine to further service up to two additional years for every year TA is received. The impact of providing TA as a part of the LLL program may improve morale and the propensity for a Marine to stay on active duty who otherwise might leave the Marine Corps.

Because LLL compared to ADP, SEP or LEP does not intend to produce an officer with a graduate degree for specific use, the impact of this program on an officer's performance in his regular duties becomes irrelevant. In the case of LLL the forces of human capital theory still affect both the individual and the Marine Corps. The individual officer may receive some performance benefit through LLL but his decision to participate is based on intrinsic motivation to achieve some personal benefit. Conversely, while it may appear the benefit of LLL is solely on the part of the officer who receives further education at relatively low cost the Marine Corps reaps the benefit of retaining that officer on active duty thus avoiding the cost of recruiting and training another Marine. If the Marine who participates in LLL achieves a degree the Marine Corps may also benefit by his potentially higher productivity. Regardless, the Marine Corps retains the Marine on active duty the moment TA is received thereby achieving the goal of LLL. When comparing Non-PME graduate programs to PME graduate programs, it is apparent the objectives of LLL and the manner in which it is administered are so significantly different from either category that including LLL in our comparative analysis may introduce effects not germane to this study. For this reason LLL is omitted from the Non-PME graduate education category.

C. CHAPTER SUMMARY

This chapter has described the two major categories of education available to Marine officers as PME and Non-PME. The chapter establishes why various education

programs are classified as PME or Non-PME. A description of which Marine Corps programs are included in our two categories is provided to ensure congruence of program mission/purpose and utilization of graduates in each. Programs included in either category remain mutually exclusive, avoiding the problems of evaluating the effects of several programs on one officer.

The common characteristic of the PME and Non-PME schools in our study is that a graduate education is attained and may result in the receipt of a Master's degree. By classifying Marine Corps education programs into these two groups this chapter considers similarities in each program with regard to the level of education and the general content of the areas of study. The principle difference between PME and Non-PME is that the disciplines in which PME confers a graduate education are all military in nature (e.g. warfighting theory, doctrine, planning or execution) and therefore are specific education which may influence officer performance immediately. Conversely, Non-PME graduate programs provide an education in disciplines that have some military application but may not be specifically military in nature (e.g. management, aeronautical engineering, computer science) and are therefore general education, which may also affect performance either immediately or long term.

IV. PERFORMANCE EVALUATION SYSTEM

The preceding chapters of this thesis categorize Marine Corps education programs as PME and Non-PME. Within those two categories, certain programs were excluded to avoid potential bias from the effects of incongruent education programs. This chapter describes our metric for analyzing PME and Non-PME graduate programs. Our description draws on the strengths and addresses weaknesses of similar metrics used in prior studies reviewed in Chapter II. This study uses the Marine Corps Performance Evaluation System and its primary component, the fitness report, as the metric to compare the effects of PME and Non-PME graduate education on officer performance.

A. FITNESS REPORT

The U.S. Marine Corps presently operates a single medium for "reporting, recording, and analysis of the performance and professional character of Marines". (MCO P1610.7E, Dec 1998). This is the Performance Evaluation System, which employs the fitness report (fitrep) as the means to accomplish the stated purpose. The objectives of the PES, however, are not accomplished solely through the fitrep but rather through a series of actions taken by officers charged with using the fitrep to evaluate a subordinate's performance.

The objectives of the PES are, first, the completion of an accurate fitrep that evaluates the performance of a Marine officer, referred to hereafter as the Marine Reported On (MRO). A fitrep is completed periodically for all officers up to the rank of major general by officers senior in rank or position and in the immediate chain of command. Occasion for completion of a fitrep occurs, at a minimum, once a year during a designated month according to rank of the MRO. Marine officers who are responsible for the evaluation of another's performance are the Reporting Senior (RS) and the Reviewing Officer (RO). The RS and RO are the senior officers in the chain of command in the two immediate superior levels above the MRO. The evaluation of a Marine by both the RS and RO insures that the fitrep accurately reflects the performance of an officer in his assigned duties given the established set of requirements for his position/billet.

The second objective of the PES is the prevention of inflation in fitness report grades. The fitness report consists of four sections that allow the RS and RO to grade the MRO on 14 performance items. The attributes are divided into four groups: mission accomplishment, individual character, leadership, and intellect and wisdom. The grades assigned to each item range from 'A', which represents the lowest level to 'G', which represents the highest level of proficiency. An example of a fitness report, the different graded items and the grading spectrum for each is shown in Appendix A.

Grade inflation may result when either the RS or RO do not objectively evaluate a Marine's performance. Prevention of inflated grades is accomplished by requiring that reporting officials complete fitreps based only on "fact and...objective judgments based on Marine Corps standards; not conjecture." (MCO P1610.7E, Dec 1998). The fitness report also includes a section below each attribute's grade where the RS must provide a narrative justification for grades of A(the lowest), F or G(the highest). The design of this report limits the ability of an RS to grade an MRO at the lowest level (A) or the two highest levels (F and G) without some substantive rationale or specific examples. The result is a fitrep that effectively reduces grading inflation or deflation. In some cases where the RS or RO have not had the opportunity to observe an MRO demonstrate, in the performance of his duties, any level of proficiency for a particular attribute, a grade of (H) may be given. The grade (H) represents "not observed" and does not require a justification statement. It does, however, prevent the RS from making an assumption about an MRO's proficiency in an area that was not specifically observed and thereby also prevents the possibility of inflation or deflation. Finally, the current fitness report assigns a relative value for the summed total of all graded attributes to help reduce the inflation. The relative value for a fitness report is a numerical grade that is calculated for all graded traits and summed to provide a single numeric grade. That grade is then compared to the average numeric grade given by the RS on all previously written fitness reports. Through this comparison a relative value may be assigned to a fitness report that takes into consideration the reporting trends, whether high or low, for an RS thereby reducing inflation.

Other objectives of the PES are the timely completion and submission of fitness reports by reporting officials to the Manpower Management Support Branch at

Headquarters Marine Corps. Timely refers to the completion of a fitrep and submission to Headquarters Marine Corps within 30 of the end of the reporting occasion in which the MRO's performance is being evaluated. Completeness and administrative correctness of fitreps are the remaining objectives of the PES. Completeness refers to having all sections of a fitness report completed or providing an explanation why an omission occurred. Administrative correctness refers to assuring that all information that identifies the MRO, RS, RO and relevant command is correct thereby insuring that the record of a Marine's performance is properly and quickly entered into his Official Military Personnel File (OMPF) at Headquarters Marine Corps. All involved parties (i.e., MRO, RS and RO) achieve these objectives of the PES only through the specific compliance with policy and administrative procedure outlined in Marine Corps Order P1610.7E, December 1998.

The intended uses of the PES are to support centralized selections of officers for all Marine Corps education programs, promotion, retention, duty assignments and other personnel management decisions. General Charles Krulak, Commandant of the Marine Corps stated the significance of the PES and the fitreps as follows:

The completed fitness report is the most important information component in manpower management. It is the primary means of evaluating a Marine's performance. The fitness report is the Commandant's primary tool available for the selection of personnel for promotion, retention, augmentation, resident schooling, command, and duty assignments. Therefore, the completion of this report is one of an officer's most critical responsibilities. Inherent in this duty is the commitment of each reporting senior and reviewing officer to ensure the integrity of the system by close attention to accurate marking and timely reporting. Every officer serves a role in the scrupulous maintenance of this evaluation system, ultimately important to both the individual and the Marine Corps. Inflationary markings only serve to dilute the actual value of each report, rendering the fitness report ineffective. Reviewing officials will not concur with inflated reports. (MCO P1610.7E, Dec 1998).

The presence of such strong policy and attention to the integrity of the PES make it the best measure for evaluating an officer's performance. For this reason, our analysis will use a quantifiable performance index (PI) derived from the graded items from the

fitness report as our metric for determining the effects of PME and Non-PME graduate education on officer performance.

B. PERFORMANCE INDEX

1. The Fitness Report Performance Measure

As described in Chapter II of this thesis, the studies by Roush (1972), Lloyd (1977), Estridge (1995) and Branigan (2001) recognized the benefits of using a performance index derived from officer fitness reports. This study uses the same rationale in developing a PI by quantifying the letter grades on a fitrep into a numeric scale that is then consolidated into a single score per fitrep per officer. The rationale for this choice is that, to determine the performance impact of a particular treatment, in this case a graduate program, a common metric of performance is necessary. The more accurately the selected metric reflects the true performance of an officer, the more accurately the effects of a given treatment can be determined.

Although we recognize the accuracy of the fitness report and the performance index derived from it we also are aware that it is not without limitations. First, the fitness report currently being administered under the PES consists of 14 graded items and while the grading scale for each of those attributes can easily be converted to a numeric scale and summed (or averaged) to produce a performance index, some of those attributes lack reasonable applicability to the effects of education, graduate or otherwise. For example, the fitrep includes in Section E.1., the attribute of 'courage'. Courage is defined as:

Moral and physical strength to overcome danger, fear, difficulty or anxiety. Personal acceptance of responsibility and accountability, placing conscience over competing interests regardless of consequences. Conscious, overriding decision to risk bodily harm or death to accomplish the mission or save others. The will to persevere despite uncertainty. (MCO P1610.7E, Dec 1998)

Courage represents an intrinsic characteristic that compels an officer to achieve given missions and objectives and risk personal peril in doing so. Courage is a subjective attribute that is not easily quantified by any grading scale. Further, the correlation between courage and education may be weak. Therefore, to include the courage score in the performance index used to measure effects of graduate programs would detract from

the validity of the performance index. For this reason, not all of the 14 graded attributes presented in the fitness report are included in the performance index. Our performance index consists of only those attributes that are most logically associated with the effects of graduate education or supported through previous studies. A complete description of included attributes and the rationale supporting their inclusion is given below in Chapter V.

2. Other Performance Measures

Prior studies of the effects of graduate education have used other performance measures. A metric such as officer promotion has been used effectively in the past and is accepted as a valid proxy for officer performance. The rationale for using promotion as a proxy is supported by the precepts that govern the conduct of any promotion board and the Marine Corps Promotion Manual.

The Promotion Manual states that officers are "selected for promotion for their potential to carry out the duties and responsibilities of the next higher grade based upon past performance as indicated in their official military personnel file [OMPF]." The OMPF is the principle source of information on an officer that may be considered according to law established in U.S. Code, Title 10, Sections 576, 615, 14106, and 14107. Marine Corps policy states accordingly "The primary source of information furnished to a selection board is the OMPF which contains fitness reports, awards, and other information". (MCO P1400.31B, Feb 2000). Given that consideration for officer promotion is primarily based on information contained in the OMPF of which fitreps are a part, it is reasonable to conclude that promotion is a function of performance. The relationship between officer performance and promotion is further validated by the guidance levied through the promotion board precept.

A promotion board precept is a legal document sent from the Secretary of the Navy that appoints the President of the Promotion Board that provides guidance for selection of board members, and gives instructions on the conduct of the board and factors that should be considered when recommending a particular officer for promotion. According to the guidance set forth in the promotion board precept, officer performance, as reflected in his OMPF, is the most important factor for consideration. Thus, the

precept supports the validity of the assumption that promotion is a function of officer performance.

For the reasons stated above, promotion has become a widely accepted proxy for measuring Marine officer performance. However, promotion has some inherent weaknesses. The weakness of the promotion proxy is that it includes the effects of other factors that may not be associated with officer performance. These other factors include : Primary and/or secondary MOS, billet assignments, time spent in operational (combat) units, time in service, time in grade, and selection zones. Information on these factors resides in an officer's OMPF and is considered in the promotion board process. However, these factors may not accurately reflect performance. For example, a Marine's primary MOS or choice to obtain a secondary MOS early in his career can impact his promotion potential. Promotion board precepts give special consideration to officers in an MOS that has a "critical shortage." Hence, an officer's selection of MOS may offer some advantage in promotion regardless of performance.

Factors such as time in service, time in grade and selection zones also impact whether one officer is selected for promotion. If an officer does not possess the required amount of time in service or grade, he may not fall within the promotion zone (i.e., the eligible population of officers considered for promotion) for a given promotion board. Finally, factors such as assignment to a variety of billets such as operational (combat) units, joint duty or staff billets are given special consideration, as the experience gained in those billets is a desirable trait considered by promotion boards: "When reviewing an officer's qualifications for the next higher grade, you [the promotion board] should consider that the Marine Corps benefits when the officer corps possesses a broad spectrum of experiences." (SECNAV, Precept Convening a Selection Board, Oct 2002).

C. CHAPTER SUMMARY

To provide the most credible metric for comparing the performance of PME and Non-PME graduates this study relies on a performance index derived from the graded attributes on fitness reports. This chapter describes the rationale and utility of a performance index and is supported by policy and practice of the Marine Corps in

evaluating officer performance. Some of the limitations that using a proxy as the metric for comparison may present are also addressed.

The fitness report is the most effective means to evaluate performance. By using numerical scores of graded items on fitreps this study can quantify performance differences between different populations of officers. We expect this metric to provide a more reliable indicator of performance differences than one based on promotion. The fitness report attributes used in the formulation of our performance index and the explanatory variables that predict changes in that index are explained in detail in Chapter V.

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V. PRELIMINARY ANALYSIS

A. DATA

1. Sources

The sources of data are the USMC Total Force Data Warehouse (TFDW) the Center for Naval Analysis (CNA) and the Office of the Registrar, Naval Postgraduate School. Figure 2 below represents the individual files that were merged by social security number to construct the data set used in the analysis.

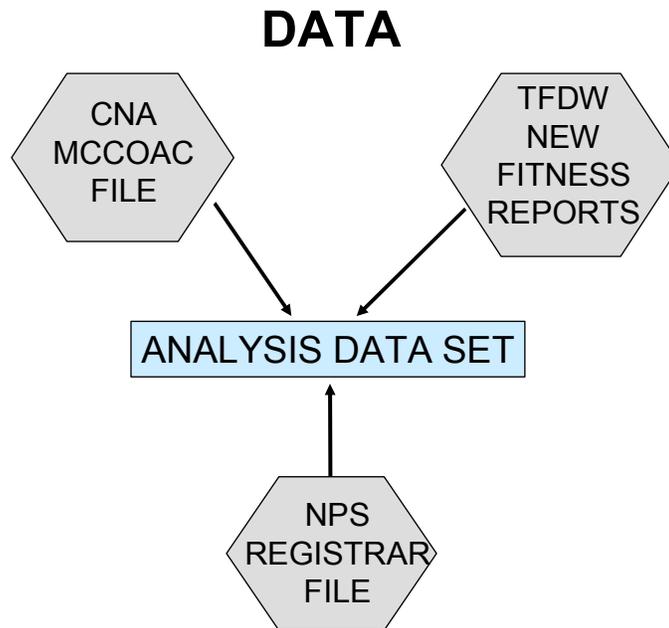


Figure 2. Sources of Data

The primary source for demographic and career data was the Marine Corps Commissioned Officer Accession Career (MCCOAC) file provided by CNA. The primary source for new fitness report data was TFDW. The NPS Registrar file was used to determine the officers who graduated from SEP. The officers who graduated from CSC, MCWAR, and ADP were identified in TFDW. There are 994 officers observed in the study, who received 5,577 new fitness reports during the 1999-2001 period.

2. Collection and Manipulation

Our data collection and manipulation methods are based on the research of Roush (1972) and Lloyd (1977). Data were collected to facilitate the observation of performance before and after graduate education as shown in Figure 3 below. The observation period from JAN 99 to JAN 03 was chosen because the new fitness report system, which is purported to be a more accurate measure of performance, became mandatory for use beginning JAN 99. For this reason the observation period extends for only four years.

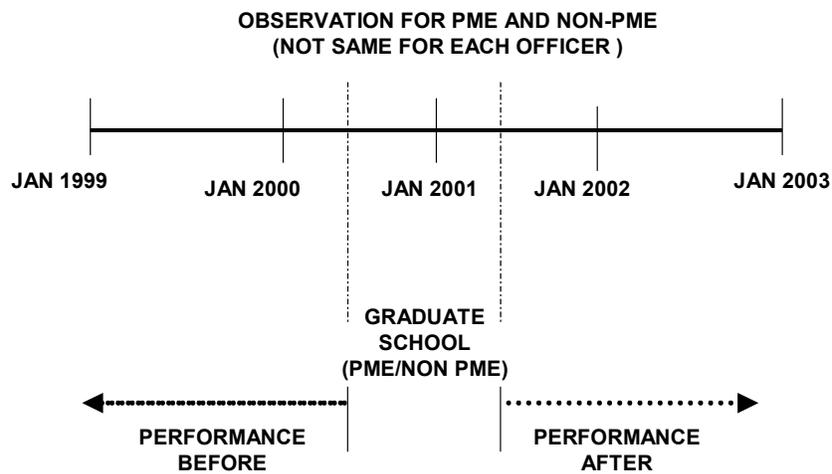


Figure 3. Time Period of Data Collected for Graduate Programs

Data were collected on consecutive observations of the same officer with respect to performance and other explanatory variables. Data were formatted in cross sectional files. We chose to format the data in this form to facilitate testing the different multivariate models (discussed later in Chapter VI).

Fitness report data, demographic data, and career data on three groups of officers were collected within the time period constraint of JAN 99 to JAN 03. Two “treatment groups” were established -- all officers who graduated from PME (PME group) between JAN 99 and JAN 03, and all officers who graduated from Non-PME graduate school (Non-PME group) between JAN 99 and JAN 03. Although graduation date is not the

same for every officer in our data, in all cases the officers observed have at least one fitness report that occurs before they attended graduate school and at least one that occurs after. A control group or “comparison group” was established -- a random sample of officers who, between JAN 99 and JAN 03, attended neither PME nor Non-PME graduate school. This group is referred to as the “No School Group” or NOS group.

The establishment of the NOS group was required as a base case to conduct the comparative analysis between PME and Non-PME officers. The primary focus of this study remains comparing the effects of PME graduate education and Non-PME graduate education on officer performance, but comparing these cases to a group having no advanced education will provide a baseline of the effects of both types of educational treatment. The use of a comparison group is standard in program evaluation research.

All officers are categorized into one of these groups. Officers who attended both PME and Non-PME programs were removed from the data set to ensure no overlapping of groups. All officers across the three groups (PME, Non-PME, and NOS) have fitness reports for the entire 4-year duration. Tables 1 and 2 below provide frequencies of officer groups and rank.

Group	Frequency	Percentage
PME	364	36.62
Non-PME	132	13.28
NOS	497	50.00

Table 1. Frequency of Officers in Groups in Sample (N=994)

Rank	Frequency	Percentage
O2	1	.10
O3	350	35.21
O4	421	42.35
O5	217	21.83
O6	5	.50

Table 2. Frequency of Rank in Officer Sample (N=994)

3. Treatment Point

The ‘treatment point’ is the demarcation point used to determine the period of observation before treatment (graduate education) and the period of observation after treatment. For the PME and Non-PME groups, the treatment point is the time spent during the respective graduate program. The before and after periods for the treatment groups were determined by identifying the fitness reports before attendance at PME or Non-PME graduate school and those after attendance. Table 3 illustrates the before and after periods for a hypothetical officer who attends PME or Non-PME graduate school.

	YEAR	SSN	COMMAND	PERFORMANCE
1)	1999	111 22 3333	HMM 165	<i>fitness report marks</i>
2)	2000	111 22 3333	HMM 165	<i>fitness report marks</i>
3)	2001	111 22 3333	NAVAL PGS	<i>unobserved report</i>
4)	2002	111 22 3333	MANPOWER	<i>fitness report marks</i>
5)	2003	111 22 3333	USS TUB	<i>fitness report marks</i>

Table 3. Hypothetical ‘Before’ and ‘After’ Fitness Report Periods for PME and Non-PME Officer

As illustrated in Table 3, fitness reports are available for the period covering 1999 to 2003. The highlighted fitness report in Table 3 is an unobserved report from attending SEP, the Naval Postgraduate School. Thus, the officer is categorized in the Non-PME group. The ‘before’ fitness reports are reports 1 and 2. The after fitness reports are 4 and 5. This technique of dividing time into ‘before’ and ‘after’ periods with respect to the treatment point was repeated for all officers within the Non-PME group and the PME groups.

The treatment point for the NOS group was identified as follows. Because the control group, NOS, received no treatment it was necessary to create a convention that would divide NOS officer fitness reports into ‘before’ and ‘after’ time periods. Figure 4 below illustrates this convention.

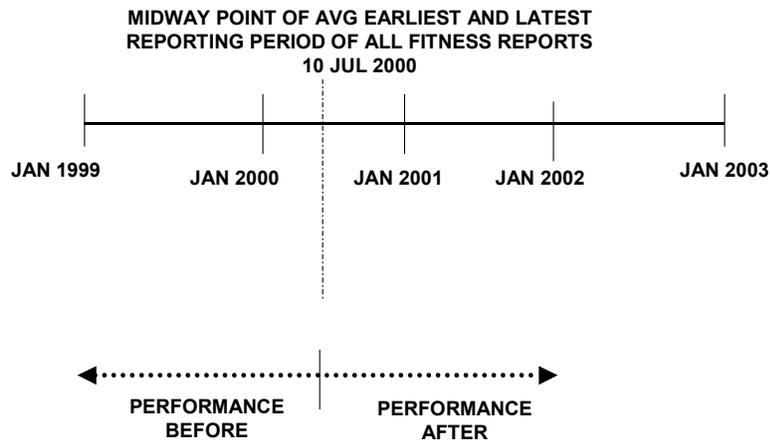


Figure 4. Determining ‘Before’ and ‘After’ Period for NOS Officers

To maintain uniformity between the NOS and PME/Non-PME treatment period, the average earliest starting period of observation on all fitness reports and the average latest ending period of observation on all fitness reports was determined. The time between average earliest and average latest fitness report dates was divided in half. This midway point in time was identified as 10 JUL 2000, which became the separation point between before and after performance for the NOS group. Once this date was determined for the NOS group, the three groups could be treated similarly with respect to ‘before’ and ‘after’ periods. Table 4 below is an example record of a hypothetical NOS officer; the ‘before’ period includes periods 1 and 2 while the ‘after’ period includes periods 4 and 5. Keeping consistent with the convention for creating a ‘before’ and ‘after’ period for NOS officers, the fitness report for period 3 is deleted from the record.

SSN	COMMAND	DATE	PERFORMANCE
1) 222 33 4444	HMM 233	17 DEC 1999	<i>fitness report marks</i>
2) 222 33 4444	HMM 233	23 MAY 2000	<i>fitness report marks</i>
3) 222 33 4444	3MAW	10 JUL 2000	<i>fitness report marks</i>
4) 222 33 4444	3MAW	20 DEC 2001	<i>fitness report marks</i>
5) 222 33 4444	3MAW	01 JAN 2003	<i>fitness report marks</i>

Table 4. Hypothetical ‘Before’ and ‘After’ Fitness Reports for NOS Officers
4. Performance Index

The formulation of our performance index was based on the research of Estridge (1995) and Branigan (2001). After dividing the four-year observation period into before and after periods for PME, Non-PME, and NOS, the variable of interest “performance” was calculated. First, performance index (PI) was defined. Note that the alphabetical grading system of A thru H used in the new fitness report was first converted to a corresponding numerical grading system. Thus, the markings in the respective categories range from 1 (the lowest) to 7 (the highest). PI is the summation from one fitness report of the markings in the *communication skills, decision-making ability, initiative, performance, proficiency, judgment, and developing subordinates* categories. Scores are then divided by 7 to obtain the PI for each fitness report. In all fitness reports used for the analysis, officers were graded in all seven of the selected performance attributes. The calculation is illustrated in the following equation.

For officer i in period t

$$PI_{it} = \frac{\Sigma(\textit{communication skills, decision making ability, initiative, performance, proficiency, judgment, developingsubordinates})}{7}$$

The greatest possible value of PI for one fitness report is 7 and the lowest possible value is 1. As previously noted in Chapter IV, the reason for choosing the seven specific performance attributes was that they are the most likely attributes to be impacted by advanced education, either PME or Non-PME. We omitted *courage, effectiveness under stress, leading subordinates, ensuring the well being of subordinates, and setting example* because they are unlikely to be affected by either program. The relative value scores on fitness reports could not be used in the analysis. Relative value is determined by comparing the Marine Report On fitness report score to the Reporting Seniors cumulative average. The RS’s cumulative average includes all 14 performance attributes. Using any metric that is not based exclusively on the seven selected items would incorporate performance elements that are not likely to be affected by graduate school. The potential benefit gained by using a relative value PI, however, is not lost in our selection of seven traits. The strength of the new fitness report is that it significantly reduces grade inflation, which results in a normal distribution of PI for the officers in the sample.

Descriptive statistics for PI, which include all three groups (PME, non-PME and NOS) and excludes any unobserved fitness reports, are indicated Table 5. A comparison of the mean value (4.360) and the median value (4.428) of PI indicates that its distribution is approximately normal across the sample.

Variable	Minimum	Maximum	Mean	Median	Standard deviation
PI	1.0	7.0000	4.3601	4.4286	.9273

Table 5. Measures of Central Tendency and Variation of PI

The record shown in Table 6 below is for a Non-PME officer. Notice that the PI for time at NPS is zero because the fitness report was unobserved. Unobserved fitness reports were deleted from all officers’ records and not included in calculations of the performance index. Additionally, all officers who experience a grade change during the four-year observation period are excluded from the analysis.

	SSN	COMMAND	PI
1)	131 23 6789	HMM 165	4
2)	131 23 6789	HMM 165	4
3)	131 23 6789	NAVAL PGS	0
4)	131 23 6789	MANPOWER	6
5)	131 23 6789	USS TUB	6

Table 6. ‘Before’ and ‘After’ Performance Indexes for Non-PME Officer

The following definitions of PI were calculated:

$$\text{a.) } \text{avgPI}_{\text{before}} = \frac{\sum (\text{PI}_{\text{before}})}{n_{\text{before}}}$$

$$\text{b.) } \text{avgPI}_{\text{after}} = \frac{\sum (\text{PI}_{\text{after}})}{n_{\text{after}}}$$

$$\text{c.) } \text{avg}\Delta\text{PI} = \text{avgPI}_{\text{after}} - \text{avgPI}_{\text{before}}$$

Definitions (a) and (b) show the average PI before and after the PME or Non-PME treatment. For example in Table 6 the officer earns an avgPI_{before} of 4.0 and an avgPI_{after} of 6.0 after Non-PME graduate education. Thus the difference, (c) avgΔPI is 2.0. The above variables were calculated for every officer in the entire sample (PME, Non-PME, NOS) and within each group respectively. Table 7 below is an example of the result of performance data after conducting the described procedures. The records of four officers are depicted. Each officer is a single observation identified by social security number. For each officer the three performance indices are calculated and the group to which the officer belongs is indicated.

OBS	avgPI _{before}	avgPI _{after}	avgΔPI	GROUP
111 22 3333	4	6	2	PME
222 33 4444	7	5	-2	NOS
333 44 5555	3	7	3	Non-PME
555 66 7777	4	6	2	Non-PME

Table 7. Example of Officer Records with Performance Data

Of the three performance indexes avgPI_{after} and avgΔPI are used as the dependent variables to represent performance in determining the effects of graduate education on performance. These two indexes are the most useful of the three in explaining performance subsequent to the treatment point. The strength of avgPI_{after} is that it does not include any performance prior to the treatment. It allows our analysis to accurately determine performance after a particular treatment without introducing the effects of differences in performance before the treatment. The strength of avgΔPI is that it

measures the change in performance experienced by an officer, regardless of group. The avg Δ PI provides a frame of reference for which to assess the effect of graduate education on performance regardless of differences in average performance between groups in our sample.

After calculating the performance indices, the performance data set was merged with demographic, cognitive, and career data from the MCCOAC file. This provided the data set used for analysis.

B. HYPOTHESES

The goal of this study is to determine the effect of Marine Corps graduate education on officer performance. To this end the analysis attempts to answer our research questions by testing three hypotheses. Figure 5 below depicts the research questions and hypothesis testing logic.

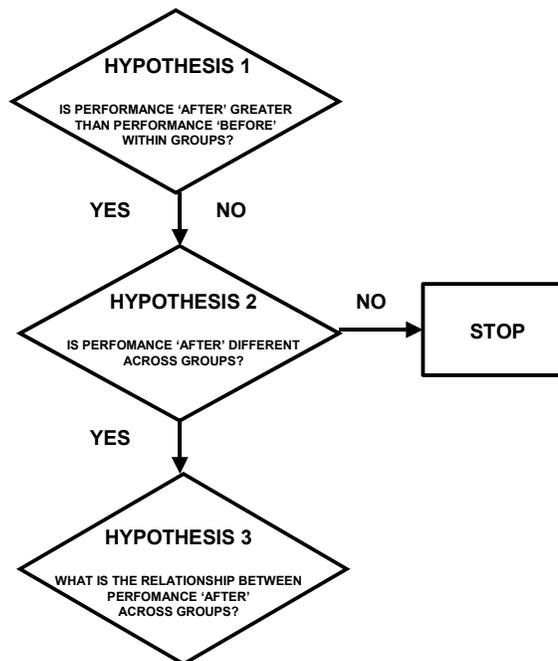


Figure 5. Hypothesis Testing Logic

Testing hypothesis 1 will answer the question if performance ‘after’ the treatment point is greater than performance ‘before’ in all three groups. Our first hypothesis is that the measure of performance after graduate education, whether PME or Non-PME, will be

greater than performance before. The a priori hypothesis, based on prior studies, is that advanced education improves on-the-job performance. Hypothesis 1 is stated below.

Hypothesis 1

$$H_0: \text{avgPIafter}_{\text{PME/Non-PME/NOS}} = \text{avgPIbefore}_{\text{PME/Non-PME/NOS}}$$

$$H_A: \text{avgPIafter}_{\text{PME/Non-PME/NOS}} > \text{avgPIbefore}_{\text{PME/Non-PME/NOS}}$$

Following our logic, the next question asks whether performance subsequent to the treatment point differs across the groups PME, Non-PME, and NOS. In answering this question we conduct our first comparative analysis of the effects of graduate education on performance across the groups. Hypothesis 2 is that performance after the treatment point across the three groups is not equal:

Hypothesis 2

$$H_0: \text{avgPIafter}_{\text{PME}} = \text{avgPIafter}_{\text{Non-PME}} = \text{avgPIafter}_{\text{NOS}}$$

$$H_A: \text{avgPIafter}_{\text{PME}} \neq \text{avgPIafter}_{\text{Non-PME}} \neq \text{avgPIafter}_{\text{NOS}}$$

$$H_0: \text{avg } \Delta\text{PI}_{\text{PME}} = \text{avg } \Delta\text{PI}_{\text{Non-PME}} = \text{avg } \Delta\text{PI}_{\text{NOS}}$$

$$H_A: \text{avg } \Delta\text{PI}_{\text{PME}} \neq \text{avg } \Delta\text{PI}_{\text{Non-PME}} \neq \text{avg } \Delta\text{PI}_{\text{NOS}}$$

As stated earlier, our analysis of the effects of graduate education on performance will be tested using both avgPIafter and avgΔPI as variables explaining performance.

Our final question to be answered is, given that performance after the treatment point across groups is different, how does the ‘after’ performance of each group compare to one another. Answering this question by testing hypothesis 3 directly compares the effect of PME and Non-PME graduate education on performance. This is the main focus of our thesis.

The cultural perception, described in Chapter I, asserts that PME graduate education provides greater benefits to an officer. However, our practical experience and

recent data on the 2002 Lieutenant Colonel and Major promotion rates, shown in Table 8, suggest that non-PME graduate education may provide greater benefits to an officer. In Table 8, the Non-SEP category includes all who do not attend SEP (i.e., PME and NOS officers by our grouping criteria).

	LtCol Selection Rate (%)	Major Selection Rate (%)
SEP	68.1	94.9
Non-SEP	65.2	87.3
Board Average	65.7	88.0

Source: Headquarters Marine Corps, Personnel Management Division website, (<https://osprey.manpower.usmc.mil/promotion+selection+rates+sep+officer>) accessed September 2002.

Table 8. FY 2002 Selection Rates for Promotion to LtCol and Maj

Thus our a priori reasoning, which may be counter to the current Marine Corps perception, is that Non-PME, or traditional graduate education, has a greater impact on performance than PME education. Hypothesis 3 is stated below:

Hypothesis 3

$$H_0: \text{avgPI}_{\text{after Non-PME}} = \text{avgPI}_{\text{after PME}}$$

$$H_A: \text{avgPI}_{\text{after Non-PME}} > \text{avgPI}_{\text{after PME}}$$

$$H_0: \text{avg}\Delta\text{PI}_{\text{Non-PME}} = \text{avg}\Delta\text{PI}_{\text{PME}}$$

$$H_A: \text{avg}\Delta\text{PI}_{\text{Non-PME}} > \text{avg}\Delta\text{PI}_{\text{PME}}$$

C. ANALYSIS OF MEANS

1. Analysis Within Groups

Our preliminary analysis begins with an analysis of means of the performance indices within groups, a technique borrowed from Roush (1972) and Lloyd (1979). Tables 9 provides descriptive statistics on the PI variable by treatment group.

Group	avgPIbefore	avgPIafter	Difference in means avgPI before and avgPIafter = avg Δ PI	Percent increase	t-value
PME	4.41	4.88	.475***	10.8	8.54
Non-PME	4.18	4.41	.228***	5.45	2.58
NOS	4.04	4.44	.399***	9.87	11.80

*Comparisons significant at the .001 level are indicated by***
N = 994.*

Table 9. Performance Indices within Groups

Table 9 provides evidence that supports the first hypothesis that performance after the treatment point is greater than performance before. In a one sided t-test between before and after average PI within the groups the difference in means is statistically significant. Thus, for officers who attend PME and Non-PME graduate education performance ‘after’ is greater than performance ‘before.’ The same case holds true for the NOS group. The analysis also reveals that the difference (avg Δ PI) between the means values of performance ‘before’ and performance ‘after’ within groups is positive and statistically significant. All groups realize a positive increase in performance across the four-year period. The PME group attains a 10.8 percent increase across the observation period, the Non-PME group a 5.45 percent increase and the NOS group a 9.87 percent increase.

From the results of the preliminary analysis in Table 9 we can infer that performance subsequent to the treatment point (graduate school or no graduate school) is greater than before. Therefore, we reject the null in hypothesis 1. We can also infer that all groups of officers exhibit a positive change of performance across the observation period. The results of the preliminary analysis within groups does not definitively prove or disprove that the above inferences in the cases of the PME and Non-PME groups are due in part or in whole to graduate education. The trend may be the natural progression

of increased performance, as indicated by the NOS group, and explained by added military experience.

As discussed earlier in Chapter III, an officer’s rank is operative in determining the treatment of graduate education. PME level graduate education is offered primarily at the rank of O4 and above. Because compulsory primary level PME (TBS), and MOS schooling occurs early in an officer’s career, officers are more likely to attend Non-PME graduate education after the ranks O2 and O3. Thus, due to the career timing of graduate education in the Marine Corps, there is an unequal distribution of education programs within each rank. This distribution is illustrated in Table 10.

Group	O2	O3	O4	O5	O6
PME	0	3	160	196	5
non-PME	1	72	58	1	0
NOS	0	275	202	20	0

Table 10. Distribution of Rank within Groups

The greatest representation of ranks occurs with respect to a group at O3, O4 and O5. We see that the rank that has the best representation across the three groups is O4. In light of this fact we address the disparity of rank distribution in our preliminary analysis by conducting a difference in means t-test but controlling for rank at O4. Table 11 below presents the results of the test.

Group	avgPIbefore	avgPIafter	Difference in means avgPI before and avgPIafter = avgΔPI	Percent increase	t-value
Non-PME	4.30	4.69	.391***	9.10	2.92
PME	4.41	4.71	.309***	7.00	4.18
NOS	4.44	4.72	.289***	6.50	5.30

*Comparisons significant at the .001 level are indicated by ****
N = 421.

Table 11. Performance Indices within Groups for O4

The results of the repeated one sided t-test reveal the same trends of performance ‘after’ the treatment point being greater than performance ‘before’ and a positive net increase in performance across the observation period within all three officer groups.

The analysis of means when controlling for group and rank, however, provides stronger evidence that the positive change in performance that occurs in the PME and Non-PME groups is due to participation in graduate education. Controlling for rank within O4 has removed the potential upward bias rank could impart on the effect of graduate education on performance. Thus, the results in table 11 provide stronger evidence to accept the alternative in hypothesis 1 that performance ‘after’ is greater than performance ‘before.’ Our preliminary analysis within groups shows that performance ‘after’ is statistically and practically greater than performance ‘before.’ Proceeding with our hypothesis testing, we test hypothesis 2 and hypothesis 3 through a comparative analysis across groups also controlling for rank at O4.

2. Comparative Analysis

Tables 12 and 13 show the results of testing hypothesis 2 through a comparative analysis of performance between the PME, Non-PME, and NOS officers controlled for rank at O4 using the ANOVA F-test procedure.

Hypothesis 2

$$H_0: \text{avgPIafter}_{\text{PME}} = \text{avgPIafter}_{\text{Non-PME}} = \text{avgPIafter}_{\text{NOS}}$$

$$H_A: \text{avgPIafter}_{\text{PME}} \neq \text{avgPIafter}_{\text{Non-PME}} \neq \text{avgPIafter}_{\text{NOS}}$$

ANOVA			
Dependent Variable	Control variable	F-value	Pr>F
avgPIafter	Group (PME, Non-PME, NOS)	.08	.924

Table 12. ANOVA Procedure for avgPIafter for O4

Hypothesis 2

$$H_0: \text{avg}\Delta\text{PI}_{\text{PME}} = \text{avg}\Delta\text{PI}_{\text{Non-PME}} = \text{avg}\Delta\text{PI}_{\text{NOS}}$$

$$H_A: \text{avg}\Delta\text{PI}_{\text{PME}} = \text{avg}\Delta\text{PI}_{\text{Non-PME}} = \text{avg}\Delta\text{PI}_{\text{NOS}}$$

ANOVA			
Dependent Variable	Control variable	F-value	Pr>F
avgΔPI	Group (PME, Non-PME, NOS)	.31	.731

Table 13. ANOVA Procedure for avgΔPI for O4

The results of the ANOVA F-test using avgPIafter and avgΔPI as criterion variables indicate that performance ‘after’ is not statistically different across the groups. The resultant p-values are .924 and .731, therefore, we cannot reject the null hypothesis that avgPIafter and avgΔPI across the groups are equal. We infer that although officer performance increases over time for all groups, the increases in performance of each group when compared to each other are the same. Thus, the increases in performance due to PME and Non-PME graduate education are likely no different in magnitude than the increase in performance that occurs when not attending graduate school. Since avgPIafter and avgΔPI across the groups are not statistically different in testing hypothesis 2, the need for testing hypothesis 3 is obviated.

D. CHAPTER SUMMARY

The data set used in this study were collected and formulated to support a before and after analysis of participation in Marine Corps graduate education on performance. The data set includes new fitness reports, demographic, and career information. The observation period used in the study (JAN99-JAN03) includes the time period during which use of the new fitness report was used.

The officers observed are categorized into three groups: the two treatment groups are PME and Non-PME; the comparison group is the no school or NOS group.

The testing of three hypotheses is undertaken to determine the effect of Marine Corps graduate education on officer performance. Preliminary analysis of performance indices within the groups supports the first hypothesis that performance ‘after’ the treatment point is greater than performance ‘before.’ This hypothesis is strengthened when analysis reveals the same result when controlling for rank. At the completion of analysis within groups we determine that within the PME, Non-PME, and NOS group performance ‘after’ has increased in level (avgPIafter) and the change in performance (avg Δ PI) is positive. Preliminary comparative analysis across the groups indicates that the changes in performance across all three groups are not statistically different from each other when controlled for rank at O4. Specifically, that the effects of PME graduate education and Non-PME graduate education on performance when compared to each other are not different and when compared to the alternative effects due to not attending graduate school they are also not different.

Although the preliminary analysis provides some evidence to answer our research questions, further analysis is required. Our preliminary analysis shows that the addition of a single non-treatment control variable (rank) in the analysis within groups, produced results indicating the effects of graduate education on performance were different than when only controlling for group.

We accept that our ANOVA results provide a stronger analysis within a particular group when rank is controlled at O4; however, rank alone should not be considered the only variable that must be controlled in order to isolate the effect of graduate education on performance. Understanding that several other variables may also be important in the explanation of performance, we conduct multivariate analysis in chapter VI. Our multivariate analysis further isolates the effects of graduate education on performance while holding demographic, affective and cognitive variables constant. Multivariate analysis can provide evidence to infer that Marine Corps graduate education causes changes in officer performance.

VI. MUTLTIVARIATE ANALYSIS

A. MODELS

1. Theoretical Relationship and General Model

The theoretical relationship examined in the multivariate analysis has been investigated in several prior studies. The underlying theoretical relationship is that individual job performance is in part a function of education. In the current case, the hypothesis is that Marine officer performance is determined in part by graduate education.

This relationship has been estimated in prior studies by Bowman and Mehay (1999), Branigan (2001), and Estridge (1995). As noted earlier, the authors assert that officer performance is a function of demographic, cognitive, and affective traits as in the equation below.

$$\text{Performance} = f(\text{demographic traits, cognitive traits, affective traits})$$

Our general model uses various performance indexes (PI) as dependent variables and participation in Marine Corps graduate education as the focus variable. The general model is stated below where the two performance indexes are shown:

$$\begin{array}{l} \text{avgPI after} = f[\text{demographic traits, cognitive traits, affective traits} \\ \text{(avg}\Delta\text{PI)} \qquad \qquad \qquad \text{graduate education (PME or Non-PME)}] \end{array}$$

The model assumes that the performance indexes, avgPI after and avg Δ PI, can be explained by characteristics of the officer, including aptitude, career attributes, and participation in Marine Corps graduate education.

The models are estimated with ordinary least squares (OLS) techniques using cross sectional data on Marine officers. Before discussing the specifications and results of the OLS estimations, the variables used in these models are introduced and explained.

2. Variable Introduction

The variables are grouped into five categories; performance indices, demographic traits, cognitive traits, affective traits, and treatment variables. Table 14 lists and describes the variables used in the multivariate analysis. Table 15 shows the frequency distribution of variables.

Variable	Description
Performance Indices:	
AvgPIafter	Continuous, = average PI after graduate PME or Non-PME graduate education
avgAPI	Continuous, = average PI after graduate PME or Non-PME graduate education
Demographic Traits:	
Non-white	= 1 if black, Hispanic, Asian, and other; = 0 if Caucasian
Female	= 1 if female; = 0 if male;
Married	= 1 if married; =0 if single or divorced
Depns	Continuous, = number of dependents
Cognitive Traits:	
GCT_top	=1 if GCT score is in top third based on distribution of scores in sample; = 0 if not in top third
GCT_mid	=1 if GCT score is in middle third based on distribution of scores in sample; = 0 if not in middle third
GCT_bottom	=1 if GCT score is in bottom third based on distribution of scores in sample; = 0 if not in bottom third
Top_TBS	=1 if TBS class rank is in top third of respective class; = 0 if not in top third
Mid_TBS	=1 if TBS class rank is in middle third of respective class; = 0 if not in middle third
Low_TBS	=1 if TBS class rank is in bottom third of respective class; = 0 if not in bottom third
Affective Traits:	
OCS	=1 if accession source is OCC, PLC, MECEP, or ECP; = 0 if not
Svc_acad	=1 if accession source is a Service Academy;

	= 0 if not
ROTC	= 1 if accession source is ROTC; = 0 if not
Prior	=1 if having at least 4yrs prior enlisted service; = 0 if not
Combat	= 1 if MOS is 03XX, 08XX, or 18XX; = 0 if not
Aviation	= 1 if MOS is 75XX; = 0 if not
Non-combat	= 0 if MOS is 03XX, 08XX, 18XX, or 75XX; = 1 if not; all other MOS variable
Treatment Variables:	
PME	= 1 if graduated from PME graduate school; = 0 if not;
Non_PME	= 1 if graduated from Non-PME graduate school; = 0 if not;
NOS	= 1 if attended neither PME or Non-PME graduate school; = 0 if attended either PME or Non-PME graduate school

Table 14. Variable Name and Description

Size of Sample (N = 994)	Frequency	Percent (%)
Demographic Variables:		
White	887	89.24
Non-white	107	10.76
Female	28	2.82
Married	463	46.58
Unmarried	531	53.42
Depns = 0	266	26.79
Depns = 1	249	25.08
Depns = 2	145	14.60
Depns = 3	198	19.94
Depns = 4	98	9.87
Depns = 5	31	3.12
Depns = 6	4	.40
Depns = 7	1	.10
Depns = 8	1	.10
Affective Variables:		
OCS	653	65.69
Svc_Acad	117	11.77
ROTC	222	22.23

Prior	103	10.36
Combat	274	27.57
Non-combat	415	42.75
Aviation	305	30.68
Cognitive Variables:		
GCT_top	231	23.24
GCT_mid	381	38.33
GCT_bottom	382	38.43
Top_TBS	438	44.06
Mid_TBS	318	31.99
Low_TBS	236	23.74

Table 15. Frequency of Variables

3. Performance Indices

AvgPIafter and avgAPI are the dependent variables in the multivariate models. Both Estridge (1995) and Branigan (2001) used performance indicators in their research. Although the selected performance index was used as an explanatory variable to predict promotion to O4 and O5, rather than as a dependent variable, their findings validate the use of variables based on fitness reports. Both authors find that their performance index variable is a significant and positive predictor of promotion. We assert that not only are performance index-based variables accurate predictors of future officer performance, but also provide accurate measures of current officer performance.

4. Demographic Traits

The prior studies cited in the literature review found that race, gender, marital status, and dependent status should be included in research examining military performance. As within any organization, social norms and potential biases based on demographics may be operative in the assessment of performance in the Marine Corps. Non-white is a binary variable that represents minority race and ethnicity. Despite contemporary emphasis on determining the impact of race on promotion, performance, and retention, most empirical research shows that race is not a significant predictor of these outcomes. Bowman and Mehay (1999), Branigan (2001), and Estridge (1995) show that race is statistically insignificant in explaining probability of promotion and retention in the military. Despite these findings, we expect that being nonwhite

(nonwhite = 1) will have a significant and negative impact on avgPIafter and avgΔPI, compared with being white (nonwhite = 0).

Female is a binary variable that indicates the gender of the officer. One hypothesis is that the culture of the Marine Corps imparts institutional bias against women. If so, this bias against women would likely emerge during fitness report reviews. Therefore, we hypothesize that an officer who is a female (female = 1) will have a lower avgPIafter and avgΔPI than a male officer (female = 0), all else equal.

Married and Dependent are variables that represent marital and dependent status. Married is a binary variable = 1 for those who are married, and = 0 otherwise. Dependent is a continuous variable. Labor economic theory asserts that employees who are married and/or who have children accumulate more job specific human capital and thus are more productive. Bowman and Mehay (2002) found that married officers received better fitness reports and were more likely to be promoted to the rank of O4 in the Navy, than single officers. Branigan (2001) reveals that marital status, and number of dependents are not statistically significant in predicting the probability of retention to 16YCS or promotion to O5 for Marine Corps officers. We hypothesize that being married (married = 1) and the number of dependents will have a positive effect on avgPIafter and avgΔPI.

Table 16 depicts the frequency of demographic variables within each treatment group. Minority representation in the Non-PME group is 15.7% greater than in the PME and NOS groups (10.7% and 9.4%, respectively). Females are equally represented in each treatment group. The PME group has a higher percentage of married individuals than the Non-PME and NOS group. The PME group also has the highest percentage of officers with one or more dependent.

Variable	Group					
	PME		Non-PME		NOS	
	Number	Percent	Number	Percent	Number	Percent
Non-white = 1	39	10.7	21	15.7	47	9.46
Non-white = 0	325	89.3	112	84.21	450	90.54
Female = 1	11	3.02	4	3.01	13	2.62
Female = 0	353	97.0	129	97.0	484	97.38
Married = 1	334	91.8	31	23.3	98	19.7
Married = 0	30	8.24	102	76.7	399	80.3
Depns = 0	24	6.59	37	27.8	205	41.25
Depn = 1 or more	340	93.4	96	27.8	292	58.8

Table 16. Frequency of Demographic Variables Within Groups

5. Cognitive Traits

GCT variables (GCT_top, GCT_mid, GCT_bottom) represent the officer's scores on the Armed Forces General Classification Test. The GCT is the Marine Corp's traditional entrance level aptitude test used to categorize Marines with respect to mental ability. The GCT tests mathematical, reading, and mechanical ability. Interestingly, despite the long-standing dependence of the Marine Corps and other services on the GCT, Estridge (1995), Branigan (2001), Roush (1972) and Lloyd (1977) show that it is not a statistically significant predictor of performance. For example, Estridge (1995) finds that officers with higher GCT scores were more likely to be promoted to O4 and O5, but the correlation was statistically insignificant. Likewise, Branigan's (2001) research reveals that GCT was insignificant in explaining promotion and retention probabilities. Finally, in Roush's (1972) and Lloyd's (1977) doctoral dissertations examining the impact of attending SEP and AWS on subsequent military fitness report marks, the marginal effect of GCT scores was also insignificant.

It is hypothesized that officers with higher GCT scores will have higher avgPIafter and avgΔPI. Despite the findings of prior studies GCT purports to assess mental aptitude and therefore should be significant factor in explaining performance.

TBS variables (top_TBS, mid_TBS, and low_TBS) indicate class standing upon graduation from the The Basic School. Class standing is determined by officer performance in academic, leadership, and military courses. The convention of dividing

TBS ranks into thirds is used by the Marine Corps for officer classification, most notably during initial MOS assignment upon completion of TBS.

Prior studies find that performance at TBS is a strong predictor of subsequent officer performance. Branigan (2001) showed that TBS grade point average (GPA), a proxy for performance comparable to TBS class rank, was statistically significant when analyzing promotion probabilities and the likelihood of completing graduate education. He reveals that officers who have higher TBS GPA's are more likely to be promoted to O5 and attain graduate degrees. We hypothesize that the relationship between TBS class rank (top_TBS, mid_TBS, and low_TBS) and performance (avgPIafter and avgAPI) will be positive.

Table 17 depicts the frequency of the cognitive variables within groups. The Non-PME group has the highest percentage of officers who score in the top third of GCT scores in the sample; the NOS group has the lowest percentage. The PME group has the highest percentage of officers who graduated from TBS in the top third of their class. The NOS group has the lowest percentage of officers who graduated in the top third of their TBS class.

Variable	Group					
	PME		Non PME		NOS	
	Number	percent	number	percent	number	percent
GCT_top = 1	82	22.5	41	30.8	108	21.7
GCT_mid = 1	125	34.3	52	39.1	204	41.0
GCT_bottom=1	157	43.1	40	30.1	185	37.2
Top_TBS = 1	181	50.0	55	41.4	202	40.6
mid_TBS = 1	114	31.5	44	33.1	160	32.2
low_TBS = 1	67	18.5	34	25.5	135	27.2

Note: less than .1 percent of observations have missing values for these variables

Table 17. Frequency of Cognitive Variables By Group

6. Affective Traits

OCS, Svc_Acad, and ROTC are variables that describe officer accession source. OCS is a binary variable = 1 if the officer was commissioned through the Officer Candidate Course (OCC), Platoon Leaders Course (PLC), Enlisted Commissioning Program (ECP) or the Marine Enlisted Commissioning and Education Program

(MECEP). *Svc_Acad* indicates if an officer was commissioned through the United States Naval Academy, the United States Military Academy, or the United States Air Force Academy. *ROTC* = 1 if the officer is commissioned through the Reserve Officer Training Corps. Prior studies show that the varying levels of military acculturation of graduates from the seven different officer accession sources affect level of performance. It is expected that programs that impart higher degrees of military acculturation produce higher performing officers. For example, Bowman and Mehay (1999) find that officers from USNA are more likely to attain graduate degrees. Estridge (1995) shows that USNA graduates are more likely to be promoted to O4 than their cohorts from other accession sources. We hypothesize that being commissioned through service academies (*Svc_acad* = 1) and ROTC (*ROTC* = 1) will have positive marginal effects on *avgPIafter* and *avgAPI* compared with commissioning through OCC, PLC, ECP, and MECEP (*OCS*=1).

Prior represents the attainment of four years of prior enlisted service before commissioning. Officers who serve at least four years enlisted service are designated O1E's upon commissioning. Branigan (2001) finds that prior enlisted experience as defined by the O1E designation is statistically insignificant in explaining retention and promotion to O5. However, the author notes that his finding may be affected by the fact that prior to promotion to O5 many O1E's reach 20YCS and separate from active service. It is believed that prior enlisted experience gives O1E's a performance advantage over their non-prior service counterparts throughout their careers. We hypothesize that having prior enlisted service (*Prior* = 1) will positively affect *avgPIafter* and *avgAPI*.

Combat, *Non-combat*, and *Aviation* are binary variables that represent three categories of officer MOS's. The grouping of MOS's into the three respective categories was based on traditional convention and skill requirements. Culturally MOS's are believed to be of two types, combat and non-combat (with aviation being a subset of combat). Combat MOS's are culturally accepted as the most critical with respect to accomplishing the mission of the Marine Corps. Non-combat MOS's are subordinate in this regard. Aviation is a separate category in that the skills required for these MOS's

differ from other MOS's. We believe that MOS grouping is significant in explaining performance but the direction of the effect is hard to sign.

Table 18 summarizes the frequencies of affective variables by group. The highest percentage of officers in all groups accessed through OCS. The Non-PME group has the highest percentage of officers who were commissioned through the Service Academies. There are relatively equal percentages of ROTC officers that participated in PME and Non-PME graduate education. Interestingly, the Non-PME group has the highest percentage of prior enlisted officers. Twice as many Non-PME officers are prior enlisted compared to PME officers. PME and Non-PME officers have the highest percentage of non-combat MOS's. NOS officers have the highest percentage of aviation MOS's.

Variable	Group					
	PME		Non PME		NOS	
	number	percent	number	percent	number	percent
OCS = 1	229	63.0	71	53.4	353	71.0
Svc_acad = 1	43	11.8	28	21.1	46	9.3
ROTC = 1	90	24.7	34	25.6	98	19.7
Prior = 1	29	8.0	22	16.5	52	10.5
Combat = 1	132	36.3	1	.75	141	28.4
Aviation = 1	90	24.7	30	22.6	185	37.2
Non_Combat = 1	142	39.0	102	76.7	171	34.4

Table 18. Frequency of Affective Variables By Group

7. Treatment Variables

The relationships between the variables PME and Non_PME and the performance indices avgPIafter and avgΔPI are the primary focus of the multivariate analysis. Our hypothesized relationship between the treatment variables and the performance indices has been stated and analyzed in previous chapters. We hypothesize that the marginal effects of PME (PME = 1) and Non_PME (Non_PME = 1) on avgPIafter and avgΔPI will be positive. Additionally, we hypothesize that Non_PME avgPIafter and avgΔPI will be relatively more important in explaining than PME.

Previous studies show mixed results on the effect of graduate education (PME and Non-PME) on performance. Bowman and Mehay (1999) find that after eliminating the

effects of selection bias, graduate education had a positive impact on the promotion of Navy officers to O4. Branigan (2001) finds that officers with traditional graduate degrees (Non-PME) are more likely to be promoted to O5. On the other hand, Roush (1972) and Lloyd (1977) find that subsequent military performance markings after attending SEP and AWS are no better than before attending the respective programs. This lack of consistency in the results of prior studies, and the results of the preliminary analysis suggests further testing of the effect of the variables PME and Non-PME on avgPIafter and avgΔPI is warranted. The following section discusses the specific multivariate models tested in our analysis. The interpretations of the results are also included.

B. SPECIFICATION AND ANALYSIS

1. Ordinary Least Squares (OLS)

The purpose of estimating Models 1 and 2 is to determine the effect of Non-PME graduate education on officer performance. Models 1 and 2 are estimated by OLS procedures. Models 1 and 2 are specified below.

Model 1 (sample = O3, O4, O5): $\text{avgPIafter} = \text{Non_PME} - \text{nonwhite} - \text{female} + \text{married} + \text{combat}$

Model 2 (sample = O3, O4, O5): $\text{avg}\Delta\text{PI} = \text{Non_PME} - \text{nonwhite} - \text{female} - \text{married} + \text{combat}$

The explanatory variables included in both Models are Non_PME, the binary variables that indicates attendance at Non-PME graduate school and those demographic and affective variables that were hypothesized to significantly affect officer performance. The dependent variables represent performance after the treatment point, and the change in performance from ‘before’ to ‘after.’

The base case for Models 1 and 2 is a no school officer (NOS) who is a single white male, with the rank of O4 and has a non-combat MOS. The NOS group is represented in the models when Non_PME = 0. Officers in the PME group are excluded from the sample for these model estimations. The purpose of using Non-PME and NOS only is to establish the marginal effect of attending Non-PME graduate school on performance as compared to attending no advanced education, all else equal. This is the approach adopted in most prior studies and will facilitate comparison. In both models

including only O3, O4, and O5 in the sample controls for rank. Estimating models 1 and 2 provide a baseline program evaluation for Non-PME graduate education.

The results are summarized in Table 19. In Model 1 the dependent variable is avgPIafter. The intercept is positive and statistically significant at the 5 percent level or greater. The intercept equals the avgPIafter of a base case officer. It states that a base case officer will have an average PI of 4.66 after the treatment point. The mean ‘after’ performance (avgPIafter) in the sample is 4.59. The coefficient for Non_PME is positive, but not statistically significant at any normally tested level.

	Model 1		Model 2	
	Dependent Variable = avgPI after		Dependent Variable = avgΔPI	
	Coeff (β)	p-value	Coeff (β)	p-value
Intercept	4.65680**	.0001	0.38226**	.0001
Treatment variable				
Non_PME	0.04633	0.4714	-0.16571**	0.0469
Demographic variables				
Nonwhite	-0.22487**	0.0077	-0.26915**	0.0136
Female	0.23203	0.1588	0.11854	0.5777
Married	0.08008	0.2065	-0.04153	0.6125
Cognitive variables				
-----	-----	-----	-----	-----
-----	-----	-----	-----	-----
Affective variables				
O3	-0.52671**	0.0001	0.09976	0.1402
O5	0.46736**	0.0014	0.09921	0.5985
Combat	.17787**	0.0050	-0.03838	0.6388
	N = 609		N = 609	
	F-stat =22.40**	.0001	F-stat =1.88*	.0706
	R-square 0.2069		R-square .0214	
**Significant at the .05 level				
*Significant at the .10 level				

Table 19. Baseline Program Evaluation Models (Non-PME)

This indicates that the marginal effect of Non_PME is not statistically different from zero. Attending Non-PME graduate education results in ‘after’ performance that is no different from the mean ‘after’ performance of an NOS officer. Thus, we can infer that

the subsequent performance of an officer who attends Non-PME graduate education is likely no different than that of an officer who does not attend. The other significant explanatory variables were nonwhite, combat, and O5. Their signs are as hypothesized. The F-stat (22.4**) shows that as a group the explanatory variables are statistically significant in explaining average performance after the treatment period.

Avg Δ PI is used as the dependent variable in model 2. Aside from not using avgPIafter on the left hand side, the specification of model 2 is identical to model 1. The intercept is positive and statistically significant at the 5 percent level or greater. The intercept equals the avg Δ PI of a base case officer. It shows that the base case officer, one who does not attend Non-PME graduate education, will have a positive change (increase) in average performance of .382. The mean change in performance (avg Δ PI) of the sample is .408. The coefficient for Non_PME is negative and statistically significant at the 5 percent level. The coefficient indicates that the performance of an officer who attends Non-PME graduate education will be lower than a NOS officer by .166, which is 40.7 percent lower. The other significant explanatory variable is nonwhite. The F-stat (1.88) for the overall model is much lower in model 2 and is significant at only the .07 level.

Combining the results of models 1 and 2 allows us to make inferences about the effect of Non-PME graduate education on performance. The models show that attending traditional graduate education results in subsequent performance that cannot be shown to be greater than the performance of an NOS officer. The estimation also reveals that the change in performance experienced by not attending Non-PME graduate education (i.e., “remaining in the fleet”) is greater than attending (i.e., “leaving the fleet.”)

The purpose of models 3 and 4 is to provide the same baseline program evaluation for PME graduate education as was conducted for Non-PME graduate education in models 1 and 2. PME graduate education is compared to the NOS group only. The base case for models 3 and 4 is a no school officer (NOS) who is a single white male, with the rank of O4 and has a non-combat MOS.

Model 3 (sample = O3, O4, O5): avgPIafter = PME - nonwhite - female + married + combat

Model 4 (sample = O3, O4, O5): $\text{avg}\Delta\text{PI} = \text{PME} - \text{nonwhite} - \text{female} - \text{married} + \text{combat}$

The results are summarized in Table 20. In model 3 the dependent variable is avgPIafter. The intercept is positive and statistically significant at the 5 percent level. The intercept equals the avgPIafter of a base case officer. It states that a base case officer, one who does not attend PME graduate education, will have an average PI of 4.69 after the treatment point. The mean ‘after’ performance in the sample is 4.59. The coefficient for PME is negative, but not statistically significant.

	Model 3		Model 4	
	Dependent Variable = avgPI after		Dependent Variable = avgΔPI	
	Coeff (β)	p-value	Coeff (β)	p-value
Intercept	4.69561 **	.0001	0.30001**	.0001
Treatment variable				
PME	-0.05578	0.4428	0.06382	0.5428
Demographic variables				
Nonwhite	-0.21525 **	0.0026	-0.23891**	0.0204
Female	0.13198	0.3194	0.09057	0.6357
Married	0.06533	0.2852	-0.00881	0.9204
Cognitive variables				
-----	-----	-----	-----	-----
-----	-----	-----	-----	-----
Affective variables				
Combat	0.10831 **	0.0175	-0.02238	0.7331
O3	-0.54190 **	.0001	0.21264**	0.0082
O5	0.31808**	.0001	0.29422**	0.0006
	N = 832		N = 832	
	F-stat =38.54 **	.0001	F-stat =3.49**	.0011
	R-square .2466		R-square 0.0288	
**Significant at the .05 level				
*Significant at the .10 level				

Table 20. Baseline Program Evaluation Models (PME)

This indicates that attending PME graduate education results in ‘after’ performance that is no different from the mean ‘after’ performance of a NOS officer. Thus, we can infer that the subsequent performance of an officer who attends PME graduate education is

likely not significantly different from that of an officer who does not attend. The other significant explanatory variables are nonwhite, O3 and combat. Their signs are as hypothesized. The F-stat (38.5**) shows that as a group the explanatory variables as specified are statistically significant in explaining average performance after the treatment period.

Avg Δ PI is used as the dependent variable in Model 4. The intercept is positive and statistically significant at the 5 percent level. The intercept equals the avg Δ PI of a base case officer. It shows that a base case officer, one who does not attend PME graduate education, will have an increase in average performance of .300. The average change in performance in the sample is .408. The coefficient for PME is statistically insignificant. Thus, we can infer that the change in performance of an officer who attends PME graduate education is not significantly different from that of an officer who does not attend. The other significant explanatory variables are nonwhite, O3 and O5. Their signs are as hypothesized. The F-stat (3.49**) indicates that the independent variables jointly are significant.

The estimation of Models 3 and 4 show that attending PME graduate education does not result in subsequent performance any different from not having attended. The estimations also reveal that the change in performance experienced by attending PME graduate education is not significantly different from not attending. Thus, the effects of attending PME graduate education results in performance that is equal to not having attended any graduate education.

The purpose of Models 5 and 6 is to provide a comparative analysis of the effects of PME and Non-PME graduate education on officer performance. In order to control for selection bias we include the full range of demographic, affective and cognitive traits. Cognitive variables are particularly important in controlling for selections bias. Because selection boards for PME and Non-PME graduate education programs use GCT score (GCT_top, GCT_mid) and TBS class rank (top_TBS, mid_TBS) to select officers for attendance, including these variables controls for cognitive skills. Therefore, the biases that the differences in innate cognitive ability impart on the estimated effects of graduate education on performance should be lessened. Models 5 and 6 provide the most reliable

analysis of how graduate education, PME or Non-PME, affects performance compared to each other and compared to no graduate education. In Models 5 and 6 we also reexamine the specification of the explanatory variables in an attempt to improve predictability (R-square). Models 1 through 4 included only the demographic and affective traits hypothesized to have the greatest predictive effect on officer performance. The highest resultant R-squares were .246 for models using avgPIafter as the dependent variable, and .028 for models using avgAPI.

The specifications of Models 5 and 6 are as follows:

Model 5 (sample = O3, O4, and O5): avgPIafter = PME + Non_PME - nonwhite - female + married + depns + top_tbs + mid_tbs + gct_top + gct_mid + ROTC + svc_acad - prior + combat + aviation - O3 + O5

Model 6 (sample = O3, O4, and O5): avgAPI = PME + Non_PME - nonwhite - female + married + depns + top_tbs + mid_tbs + gct_top + gct_mid + ROTC + svc_acad - prior + combat + aviation - O3 + O5

The base case officer for Models 5 and 6 is a no school (NOS) single white male, with no dependents, in the bottom third of GCT score, who graduated in the bottom third of TBS class, who was commissioned through OCS, is a Major (O4) and has a non-combat MOS. The data used in estimating the models were restricted to the ranks of O3, O4 and O5 and included all three groups (PME, Non-PME and NOS). The results of the estimation are summarized in Table 21.

	Model 5		Model 6	
	Dependent Variable = avgPI after		Dependent Variable = avgΔPI	
	Coeff (β)	p-value	Coeff (β)	p-value
Intercept	4.70819**	.0001	0.40381**	.0001
Treatment variables				
PME	-0.07865	0.2750	0.00112	0.9915
Non_PME	-0.05738	0.3710	-0.17786*	0.0588
Demographic variables				
Nonwhite	-0.19042**	0.0045	-0.24835**	0.0114
Female	0.03519	0.7771	0.02541	0.8891
Married	0.05046	0.4442	-0.03976	0.6808
Depns	0.01364	0.4719	0.02506	0.3674
Cognitive variables				
Top_TBS	0.23160**	.0001	0.04527	0.5644
mid_TBS	0.09287**	0.0905	-0.04214	0.6001
GCT_top	-0.07861	0.1769	-0.02781	0.7444
GCT_mid	-0.05494	0.2496	-0.05227	0.4548
Affective variables				
ROTC	0.06197	0.2283	-0.02936	0.6969
Svc_acad	0.11686*	0.0793	0.14140	0.1474
Prior	-0.24457**	0.0007	-.29407**	0.0071
O3	-0.48656**	.0001	0.13549*	0.0685
O5	0.28913**	.0001	-17686**	0.0041
Combat	-0.03720	0.4733	-0.06460	0.3957
Aviation	-0.25465**	.0001	-0.05681	0.4416
	N= 964		N= 964	
	F-stat = 20.80**	.0001	F-stat = 2.42**	0.001
	R-square = .2721		R-square= 0.0417	
**Significant at the .05 level				
*Significant at the .10 level				

Table 21. Comparative Model

The results of Model 5 in Table 21 show that an officer who does not attend either PME or Non-PME graduate education will have ‘after’ performance of 4.71. The mean after performance in the sample is 4.59. The marginal effect of Non_PME on avgPIafter is not statistically different from zero indicating that attending Non-PME graduate education results in ‘after’ performance that is the same as that of an officer who does not attend. The marginal effect of PME is also not statistically different from zero, indicating

that attending PME graduate education results in ‘after’ performance no different from that of an officer who does not attend. The other significant explanatory variables are nonwhite, top_TBS, mid_TBS, svc_acad, prior, O3, O5 and aviation. Their signs are as hypothesized. The overall F-stat (20.80**) is significant at the .01 level and shows that the explanatory variables jointly are statistically significant in explaining average performance after the treatment period. Model 5 produced an R-square of .272, which is higher than the R-square in Model 3 (.246). Given our results in Model 5, which controls for selection bias and has the best fit of explanatory variables in predicting avgPIafter, we conclude that the effects that PME and Non-PME graduate education have on performance ‘after’ are the same.

The explanatory variables in Model 6 are the same as in Model 5. The dependent variable is avg Δ PI. The intercept is positive and statistically significant at the 5 percent level. The intercept equals the avg Δ PI of a base case officer. It shows that an officer who does not attend either PME or Non-PME graduate education will have a higher increase in average performance (.404). The mean change in performance (avg Δ PI) in the sample is .408. The mean change in performance for a Non-PME officer in the sample is .230. The Non_PME coefficient indicates that an officer who attends Non-PME graduate education will have a change in performance that is 43.6 percent less than the mean change in performance in the sample. The other significant explanatory variables were nonwhite, prior, O3 and O5. The overall F-stat (2.42**) indicates that the independent variables jointly are significant. Model 6 produced an R-square of .0417, which is higher than the R-square in Model 4 (.0288). Given our results in Model 6, which controls for selection bias and has the best fit of explanatory variables in predicting avg Δ PI, we conclude that the effects that PME and Non-PME graduate education have on the change in performance are not the same. PME graduate education has no significant effect on the change in performance, while Non-PME graduate is associated with a slightly significant (.10 level) drop in performance.

In order to determine if the inclusion of the full range of demographic, affective, and cognitive variables were effective in controlling for selection bias, two comparative models predicting avgPIafter and avg Δ PI were estimated that included both treatment

variables PME and Non_PME, but excluded the cognitive variables. The results of these models can be found in Appendix B. A comparison of the differences in the PME and Non_PME coefficients between Model 5 and Model 6 to the models in Appendix B should reveal if selection bias was present. The comparisons revealed that not including cognitive variables in models predicting the effect of graduate education on performance (whether ‘after’ treatment or the change in performance is used) overstates the effects of graduate education. This suggests that the specification of Models 5 and 6 was successful in controlling for selection bias.

C. CHAPTER SUMMARY

Six multivariate models were analyzed to determine the marginal effect of Marine Corps graduate education on officer performance when controlling for the effects of demographic, affective and cognitive traits. Models 1 through 6 were estimated using OLS procedures and segmented pooled cross-sectional data. Table 22 summarizes the resultant relationships between the dependent variables (avgPIafter, avgΔPI) and the explanatory variables of interest (PME and Non_PME) in models 1 through 6.

Model	Dependent Variable	PME			Non PME		
		Hypothesized sign	Resultant sign	Coefficient value	Hypothesized sign	Resultant sign	Coefficient value
1	avgPIafter				+	+	.04633
2	avgΔPI				+	-	.16571**
3	avgPIafter	+	-	.07265			
4	avgΔPI	+	+	.10482			
5	avgPIafter	+	-	.70201	+	+	.05378
6	avgΔPI	+	+	.00112	+	-	.17786*
				**Significant at the .05 level		*Significant at the .10 level	

Table 22. Summary of Results of Multivariate Analysis

Models 1 through 4 served as a baseline program evaluation of Non-PME and PME graduate education. The estimations showed that Non-PME graduate education results in performance after the treatment point that is not significantly different from not having attended graduate education. The estimations showed that PME graduate education results in performance, using both indicators, that is not significantly greater than not having attended graduate education. Models 5 and 6 provide a comparative

analysis of the different effects that Non-PME and PME advanced education impart on officer performance. The estimations answer our primary research question. Model 5 shows that when compared to each other, the effects of PME and Non-PME graduate education on 'after' performance are no different. Model 6 shows that the effect of Non-PME graduate education on the change in performance is negative (significant at .10 level), while PME has no significant effect on the change in performance.

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VII. CONCLUSIONS AND RECOMMENDATIONS

A. CONCLUSIONS

The results of the preliminary analysis in Chapter V on the performance indexes $avgPI_{after}$ and $avg\Delta PI$ establish that Marine officer performance on fitreps increases naturally over time for each of the observed groups (PME, Non-PME, and NOS). As described in Chapter III, the PME group includes Marine officers who attended the resident Command and Staff course, the School of Advanced Warfighting or Marine Corps War College, whereas Non-PME includes Marine officers who attended SEP, ADP or LEP, and NOS includes Marine officers who attended neither. The ANOVA in Chapter V found no statistical difference between $avgPI_{after}$ and $avg\Delta PI$ for the three groups. Therefore, our initial conclusion was that attending either PME or Non-PME graduate education may increase officer performance but does not significantly alter it compared to an officer who attends neither. The ANOVA results support the argument that officer performance improves over time; however, the factors that affect that improvement may include fleet experience, demographics, or variables other than graduate education. Of those variables, the only one that was held constant across all groups was rank at O4. We cannot conclude that at the rank of O4 the benefit of PME or Non-PME graduate education results in improved performance at least as measured using fitness report scores.

Chapter VI isolates the effects of graduate education on officer performance by controlling for variables other than graduate education through multivariate analysis. The results of the multivariate analysis provide further support for the findings in Chapter V. The marginal effect of PME and Non-PME graduate education on an officer's performance 'after' ($avgPI_{after}$) is not statistically different from that of an officer who attends neither, when holding affective, cognitive and demographic variables constant. In the case of change in performance ($avg\Delta PI$) our multivariate analysis shows that the effect of Non-PME graduate education on performance is significantly smaller than no graduate education. The coefficient of the Non_PME variable is $-.177$ and statistically significant above the .05 percent level when holding affective, cognitive and

demographic variables constant. The coefficient for PME is not statistically significant. From these results, shown above in Table 21 we conclude that the change in performance from 'before' to 'after' PME graduate education is not significantly different from not attending graduate school. We may also conclude that the effect of Non-PME graduate education on change in performance (avg Δ PI) is smaller than either no school or PME.

Based on the results of our preliminary analysis and the multivariate analysis we conclude that, for the operative ranks represented in our sample (O3, O4, and O5), graduate education regardless of type does not significantly improve performance compared to not attending graduate education at all. Our findings also support the conclusion that with respect to change in performance over time, Non-PME graduate education results in a smaller increase when compared to either no school or PME graduate school. Our conclusions may only apply to the ranks of O3 through O5 and performance immediately following the attainment of a graduate education. The results of our preliminary and multivariate analysis do not predict the potential long term effects of PME or Non-PME graduate education at career points where officers achieve ranks of O6 and above and serve in senior level staff positions.

B. LIMITATIONS OF STUDY

It is likely that the long-term effects of both PME and Non-PME graduate education on officer performance are not realized immediately but only later in an officer's career when rank and job assignments require greater analytical and decision-making ability. Through the rank of O3 and O4, Marine Corps tactics and war fighting skills are more important than strategic planning and analytical decision-making skills. At the senior ranks O6 and above cognitive skills, which are more likely to be enhanced by graduate level education, become more important.

Polachek and Siebert (1993) establish that leaving one's occupational specialty or the workforce may lead to lower performance immediately upon returning to the workforce. For example, women who take maternity leave generally have lower performance immediately upon returning. In the military, the time spent away from the operational (combat) force for the purpose of training or additional schooling is similar to leaving the workforce, as the Marine is not working in his primary MOS or specialty.

We can compare the effects of leaving the operational force to the effects of leaving the workforce in the civilian labor market.

Polachek and Siebert (1993) show that performance after reentry into the workforce may return to the original trend path, as if the worker had never left. When leaving the work force is for the purpose of additional school or training, performance is expected to increase above the original trend in performance. However, initially performance may be below the original trend. We can apply the same principle to Marine Corps graduate education and hypothesize that the true benefit of graduate education is not immediately realized but only increases an officer's performance above the original trend over time. That is, after completion of education, and the return to one's occupational specialty, measured performance will be below the trend line of one who remained in the occupation, but will catch up over time.

The sample size and period of observation of our data limits our ability to effectively assess the effects of graduate education beyond the billet assignment immediately following PME or Non-PME graduate education. Because the strength of this study lies in the accuracy of the new fitness report adopted in 1999, the data are constrained to a four-year period. Further, to construct 'before' and 'after' performance indexes the data required that graduate education be attained during the four-year period of January 1999 to January 2003. Because these programs are only available to officers at particular ranks the distribution of rank for each observed group was constrained to O3 through O5. This prevented our study from predicting the effects of graduate education on officer performance beyond the first two fitness reports of a utilization tour as shown in Figure 6 below.

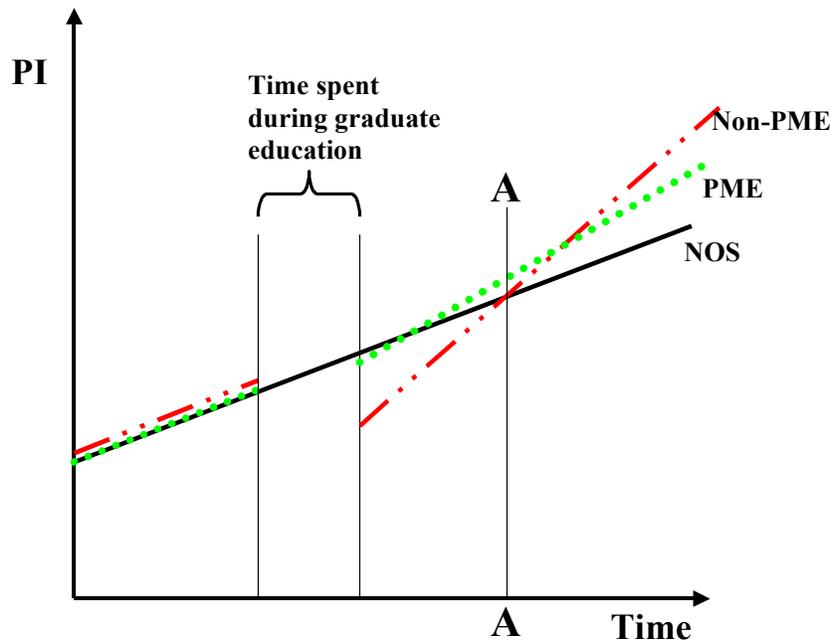


Figure 6. Hypothesized Long-Term Effect of PME and Non-PME Graduate Education

Because the data are limited to an average of two fitness reports after the treatment of graduate education, we conclude that our indicator of post-education performance has captured performance of Non-PME graduates before the point where increased performance growth kicks-in, represented by vertical line A in Figure 6. Our analysis of performance ‘after’ is constrained to the Non-PME, PME and NOS lines to the left of line A in Figure 6. The limitations of the data prevent our analysis from determining if the long-term effects of graduate education follow the same pattern of performance as in the civilian labor market described in (Polachek and Siebert, 1993), represented by the Non-PME, PME and NOS lines to the right of line A in Figure 6.

C. RECOMMENDATIONS

This study provides a framework for using the new fitness report, adopted in 1999, to assess graduate education programs. The strength of this study is the methodology of analysis, which reduces the effects of variables unrelated to the effects of education on performance. The use of the fitness report as the performance measure rather than a proxy for performance such as promotion or retention minimizes effects of

variables that are crucial to both but may not be germane to performance such as MOS shortages.

Additionally, our construction of a performance index (PI) that includes only those fitness report traits that can reasonably be assumed to be affected by education can be used to more accurately assess the performance effect of other Marine Corps education programs. Hence, we recommend that the methodology developed here be continued at the appropriate divisions such as Studies and Analysis Division, Marine Corps Combat Development Command or the Integration and Analysis Division, Manpower and Reserve Affairs in an effort to more accurately determine the performance effects of graduate education beyond initial utilization tours.

Central to the utility of our methodology is the availability of an appropriate data sample that is representative of all ranks that may potentially benefit from an education program over time. Hence our recommendation is that performance data using the new fitness report continue to be collected at the aforementioned divisions to provide the necessary data for future studies on this topic. Continuing data collections will allow the most accurate assessment of the benefits of graduate education PME, and Non-PME.

We recommend that policy makers consider the potential long-term benefits of graduate education when establishing the career requirements of Marine officers. There may be a benefit to identifying graduate education as a necessary career milestone similar to attendance at TBS or the attainment of MOS credibility, rather than treating it merely as an optional educational opportunity. Additionally, the educational opportunity and self-improvement offered by attending Non-PME programs should be further investigated for their value with respect to retention and career satisfaction as well as for the expected performance increase.

The suggested analyses could lead to credible and equitable policies that apply the same career incentive to Non-PME as exists for PME graduate education. Career incentives such as specific language in the Promotion precepts or the addition of a graded trait for advanced/graduate education on the fitness report may reduce or alleviate the cultural perception that attending Non-PME graduate education is a “career killer.” Ultimately, analysis founded on more extensive data could support such policy

modifications, which would create a culture where Marine officers who attend PME or Non-PME graduate education may benefit equally. The individual officer would benefit from the opportunity to attain advanced education without the fear of negatively impacting his career and the Marine Corps would benefit from the retention of officers who may otherwise leave the service in pursuit of educational opportunities.

APPENDIX A. MARINE CORPS FITNESS REPORT

<p>USMC FITNESS REPORT (1610) NAVMC 10835A (Rev. 1-99 (EF)) PREVIOUS EDITIONS WILL NOT BE USED SN: 0109-LF-069-0600</p>	<p>DO NOT STAPLE THIS FORM</p>																
<p>COMMANDANT'S GUIDANCE</p> <p>The completed fitness report is the most important information component in manpower management. It is the primary means of evaluating a Marine's performance and is the Commandant's primary tool for the selection of personnel for promotion, augmentation, resident schooling, command, and duty assignments. Therefore, the completion of this report is one of an officer's most critical responsibilities. Inherent in this duty is the commitment of each Reporting Senior and Reviewing Officer to ensure the integrity of the system by giving close attention to accurate marking and timely reporting. Every officer serves a role in the scrupulous maintenance of this evaluation system, ultimately important to both the individual and the Marine Corps. Inflationary markings only serve to dilute the actual value of each report. Reviewing Officers will not concur with inflated reports.</p>																	
<p>A. ADMINISTRATIVE INFORMATION</p>																	
<p>1. Marine Reported On:</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%;">a. Last Name</td> <td style="width: 15%;">b. First Name</td> <td style="width: 10%;">c. MI</td> <td style="width: 15%;">d. SSN</td> <td style="width: 10%;">e. Grade</td> <td style="width: 10%;">f. DOR</td> <td style="width: 10%;">g. PMOS</td> <td style="width: 10%;">h. BILMOS</td> </tr> <tr> <td style="height: 20px;"></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table>		a. Last Name	b. First Name	c. MI	d. SSN	e. Grade	f. DOR	g. PMOS	h. BILMOS								
a. Last Name	b. First Name	c. MI	d. SSN	e. Grade	f. DOR	g. PMOS	h. BILMOS										
<p>2. Organization:</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%;">a. MCC</td> <td style="width: 30%;">b. RUC</td> <td style="width: 40%;">c. Unit Description</td> </tr> <tr> <td style="height: 20px;"></td> <td></td> <td></td> </tr> </table>		a. MCC	b. RUC	c. Unit Description													
a. MCC	b. RUC	c. Unit Description															
<p>3. Occasion and Period Covered:</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%;">a. OCC</td> <td style="width: 15%;">b. From</td> <td style="width: 10%;">To</td> <td style="width: 15%;">c. Type</td> <td style="width: 45%;">4. Duty Assignment (descriptive title):</td> </tr> <tr> <td style="height: 20px;"></td> <td></td> <td></td> <td></td> <td></td> </tr> </table>		a. OCC	b. From	To	c. Type	4. Duty Assignment (descriptive title):											
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<p>5. Special:</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%;">a. Adverse <input type="checkbox"/></td> <td style="width: 30%;">b. Not Observed <input type="checkbox"/></td> <td style="width: 40%;">c. Extended <input type="checkbox"/></td> </tr> </table>		a. Adverse <input type="checkbox"/>	b. Not Observed <input type="checkbox"/>	c. Extended <input type="checkbox"/>													
a. Adverse <input type="checkbox"/>	b. Not Observed <input type="checkbox"/>	c. Extended <input type="checkbox"/>															
<p>6. Marine Subject Of:</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%;">a. Commendatory Material <input type="checkbox"/></td> <td style="width: 30%;">b. Derogatory Material <input type="checkbox"/></td> <td style="width: 40%;">c. Disciplinary Action <input type="checkbox"/></td> </tr> </table>		a. Commendatory Material <input type="checkbox"/>	b. Derogatory Material <input type="checkbox"/>	c. Disciplinary Action <input type="checkbox"/>													
a. Commendatory Material <input type="checkbox"/>	b. Derogatory Material <input type="checkbox"/>	c. Disciplinary Action <input type="checkbox"/>															
<p>7. Recommended For Promotion:</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%;">a. Yes <input type="checkbox"/></td> <td style="width: 30%;">b. No <input type="checkbox"/></td> <td style="width: 40%;">c. N/A <input type="checkbox"/></td> </tr> </table>		a. Yes <input type="checkbox"/>	b. No <input type="checkbox"/>	c. N/A <input type="checkbox"/>													
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<p>8. Special Information:</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%;">a. QUAL</td> <td style="width: 15%;">d. HT (in.)</td> <td style="width: 15%;">g. Reserve Component</td> </tr> <tr> <td style="width: 15%;">b. PFT</td> <td style="width: 15%;">e. WT</td> <td style="width: 15%;">h. Future Use</td> </tr> <tr> <td style="width: 15%;">c. Status</td> <td style="width: 15%;">f. Body Fat</td> <td style="width: 15%;">i. Future Use</td> </tr> </table>		a. QUAL	d. HT (in.)	g. Reserve Component	b. PFT	e. WT	h. Future Use	c. Status	f. Body Fat	i. Future Use							
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b. PFT	e. WT	h. Future Use															
c. Status	f. Body Fat	i. Future Use															
<p>9. Duty Preference:</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">a. Code</td> <td style="width: 50%;">b. Descriptive Title</td> </tr> <tr> <td>1st</td> <td></td> </tr> <tr> <td>2nd</td> <td></td> </tr> <tr> <td>3rd</td> <td></td> </tr> </table>		a. Code	b. Descriptive Title	1st		2nd		3rd									
a. Code	b. Descriptive Title																
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<p>10. Reporting Senior:</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%;">a. Last Name</td> <td style="width: 10%;">b. Init</td> <td style="width: 10%;">c. Service</td> <td style="width: 10%;">d. SSN</td> <td style="width: 10%;">e. Grade</td> <td style="width: 30%;">f. Duty Assignment</td> </tr> <tr> <td style="height: 20px;"></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table>		a. Last Name	b. Init	c. Service	d. SSN	e. Grade	f. Duty Assignment										
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<p>11. Reviewing Officer:</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%;">a. Last Name</td> <td style="width: 10%;">b. Init</td> <td style="width: 10%;">c. Service</td> <td style="width: 10%;">d. SSN</td> <td style="width: 10%;">e. Grade</td> <td style="width: 30%;">f. Duty Assignment</td> </tr> <tr> <td style="height: 20px;"></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table>		a. Last Name	b. Init	c. Service	d. SSN	e. Grade	f. Duty Assignment										
a. Last Name	b. Init	c. Service	d. SSN	e. Grade	f. Duty Assignment												
<p>B. BILLET DESCRIPTION</p>																	
<p>C. BILLET ACCOMPLISHMENTS</p>																	

1. Marine Reported On: a. Last Name b. First Name c. MI d. SSN 2. Occasion and Period Covered: a. OCC b. From c. To

D. MISSION ACCOMPLISHMENT

1. **PERFORMANCE.** Results achieved during the reporting period. How well those duties inherent to a Marine's billet, plus all additional duties, formally and informally assigned, were carried out. Reflects a Marine's aptitude, competence, and commitment to the unit's success above personal reward. Indicators are time and resource management, task prioritization, and tenacity to achieve positive ends consistently.

ADV	Meets requirements of billet and additional duties. Attitude, commitment, and competence meet expectations. Results maintain status quo.	Consistently produces quality results while measurably improving unit performance. Habitually makes effective use of time and resources; improves billet procedures and products. Positive impact extends beyond billet expectations.	Results far surpass expectations. Recognizes and exploits new resources; creates opportunities. Emulated; sought after as an expert with influence beyond unit. Impact significant; innovative approaches to problems produce significant gains in quality and	N/O			
A	B	C	D	E	F	G	H

2. **PROFICIENCY.** Demonstrates technical knowledge and practical skill in the execution of the Marine's overall duties. Combines training, education and experience. Translates skills into actions which contribute to accomplishing tasks and missions. Imparts knowledge to others. Grade dependent.

ADV	Competent. Possesses the requisite range of skills and knowledge commensurate with grade and experience. Understands and articulates basic functions related to mission.	Demonstrates mastery of all required skills. Expertise, education and experience consistently enhance mission accomplishment. Innovative troubleshooter and problem solver. Effectively imparts skills to subordinates.	True expert in field. Knowledge and skills impact far beyond those of peers. Translates broad-based education and experience into forward thinking, innovative actions. Makes immeasurable impact on mission accomplishment. Peerless teacher, selflessly imparts expertise to subordinates, peers, and	N/O			
A	B	C	D	E	F	G	H

JUSTIFICATION:

E. INDIVIDUAL CHARACTER

1. **COURAGE.** Moral or physical strength to overcome danger, fear, difficulty or anxiety. Personal acceptance of responsibility and accountability, placing conscience over competing interests regardless of consequences. Conscious, overriding decision to risk bodily harm or death to accomplish the mission or save others. The will to persevere despite uncertainty.

ADV	Demonstrates inner strength and acceptance of responsibility commensurate with scope of duties and experience. Willing to face moral or physical challenges in pursuit of mission accomplishment.	Guided by conscience in all actions. Proven ability to overcome danger, fear, difficulty or anxiety. Exhibits bravery in the face of adversity and uncertainty. Not deterred by morally difficult situations or hazardous responsibilities.	Uncommon bravery and capacity to overcome obstacles and inspire others in the face of moral dilemma or life-threatening danger. Demonstrated under the most adverse conditions. Selfless. Always places conscience over competing interests regardless of physical or personal consequences.	N/O			
A	B	C	D	E	F	G	H

2. **EFFECTIVENESS UNDER STRESS.** Thinking, functioning and leading effectively under conditions of physical and/or mental pressure. Maintaining composure appropriate for the situation, while displaying steady purpose of action, enabling one to inspire others while continuing to lead under adverse conditions. Physical and emotional strength, resilience and endurance are elements.

ADV	Exhibits discipline and stability under pressure. Judgment and effective problem-solving skills are evident.	Consistently demonstrates maturity, mental agility, and willpower during periods of adversity. Provides order to chaos through the application of intuition, problem-solving skills, and leadership. Composure reassures others.	Demonstrates seldom-matched presence of mind under the most demanding circumstances. Stabilizes any situation through the resolute and timely application of direction, focus and personal presence.	N/O			
A	B	C	D	E	F	G	H

3. **INITIATIVE.** Action in the absence of specific direction. Seeing what needs to be done and acting without prompting. The instinct to begin a task and follow through energetically on one's own accord. Being creative, proactive and decisive. Transforming opportunity into action.

ADV	Demonstrates willingness to take action in the absence of specific direction. Acts commensurate with grade, training and experience.	Self-motivated and action-oriented. Foresight and energy consistently transform opportunity into action. Develops and pursues creative, innovative solutions. Acts without prompting. Self-starter.	Highly motivated and proactive. Displays exceptional awareness of surroundings and environment. Uncanny ability to anticipate mission requirements and quickly formulate original, far-reaching solutions. Always takes decisive, effective action.	N/O			
A	B	C	D	E	F	G	H

JUSTIFICATION:

1. Marine Reported On: a. Last Name b. First Name c. MI d. SSN 2. Occasion and Period Covered: a. OCC b. From To

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F. LEADERSHIP

1. LEADING SUBORDINATES. The inseparable relationship between leader and led. The application of leadership principles to provide direction and motivate subordinates. Using authority, persuasion, and personality to influence subordinates to accomplish assigned tasks. Sustaining motivation and morale while maximizing subordinates performance.

ADV Engaged; provides instructions and directs execution. Seeks to accomplish mission in ways that sustain motivation and morale. Actions contribute to unit effectiveness.	Achieves a highly effective balance between direction and delegation. Effectively tasks subordinates and clearly delineates standards expected. Enhances performance through constructive supervision. Fosters motivation and enhances morale. Builds and sustains teams that successfully meet mission requirements. Encourages initiative and candor among subordinates.	Promotes creativity and energy among subordinates by striking the ideal balance of direction and delegation. Achieves highest levels of performance from subordinates by encouraging individual initiative. Engenders willing subordination, loyalty, and trust that allow subordinates to overcome their perceived limitations. Personal leadership fosters highest levels of motivation and morale, ensuring mission accomplishment even in the most difficult circumstances.	N/O
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A <input type="checkbox"/>	B <input type="checkbox"/>	C <input type="checkbox"/>	D <input type="checkbox"/>	E <input type="checkbox"/>	F <input type="checkbox"/>	G <input type="checkbox"/>	H <input type="checkbox"/>
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2. DEVELOPING SUBORDINATES. Commitment to train, educate, and challenge all Marines regardless of race, religion, ethnic background, or gender. Mentorship. Cultivating professional and personal development of subordinates. Developing team players and esprit de corps. Combining teaching and coaching. Creating an atmosphere tolerant of mistakes in the course of learning.

ADV Maintains an environment that allows personal and professional development. Ensures subordinates participate in all mandated development programs.	Develops and institutes innovative programs, to include PME, that emphasize personal and professional development of subordinates. Challenges subordinates to exceed their perceived potential thereby enhancing unit morale and effectiveness. Creates an environment where all Marines are confident to learn through trial and error. As a mentor, prepares subordinates for increased responsibilities and duties.	Widely recognized and emulated as a teacher, coach and leader. Any Marine would desire to serve with the Marine because they know they will grow personally and professionally. Subordinate and unit performance far surpassed expected results due to MRC's mentorship and team building talents. Attitude toward subordinate development is infectious, extending beyond the unit.	N/O
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A <input type="checkbox"/>	B <input type="checkbox"/>	C <input type="checkbox"/>	D <input type="checkbox"/>	E <input type="checkbox"/>	F <input type="checkbox"/>	G <input type="checkbox"/>	H <input type="checkbox"/>
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3. SETTING THE EXAMPLE. The most visible facet of leadership: how well a Marine serves as a role model for all others. Personal action demonstrates the highest standards of conduct, ethical behavior, fitness, and appearance. Bearing, demeanor, and self-discipline are elements.

ADV Maintains Marine Corps standards for appearance, weight, and uniform wear. Sustains required level of physical fitness. Adheres to the tenets of the Marine Corps core values.	Personal conduct on and off duty reflects highest Marine Corps standards of integrity, bearing and appearance. Character is exceptional. Actively seeks self-improvement in wide-ranging areas. Dedication to duty and professional example encourage others.	Model Marine, frequently emulated. Exemplary conduct, behavior, and actions are tone-setting. An inspiration to subordinates, peers, and seniors. Remarkable dedication to improving self and others.	N
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A <input type="checkbox"/>	B <input type="checkbox"/>	C <input type="checkbox"/>	D <input type="checkbox"/>	E <input type="checkbox"/>	F <input type="checkbox"/>	G <input type="checkbox"/>	H <input type="checkbox"/>
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4. ENSURING WELL-BEING OF SUBORDINATES. Genuine interest in the well-being of Marines. Efforts enhance subordinates' ability to concentrate/focus on unit mission accomplishment. Concern for family readiness is inherent. The importance placed on welfare of subordinates is based on the belief that Marines take care of their own.

ADV Deals confidently with issues pertinent to subordinate welfare and recognizes suitable courses of action that support subordinates' well-being. Applies available resources, allowing subordinates to effectively concentrate on the mission.	Instills and/or reinforces a sense of responsibility among junior Marines for themselves and their subordinates. Actively fosters the development of and uses support systems for subordinates which improve their ability to contribute to unit mission accomplishment. Efforts to enhance subordinate welfare improve the unit's ability to accomplish its mission.	Noticeably enhances subordinates' well-being, resulting in a measurable increase in unit effectiveness. Maximizes unit and base resources to provide subordinates with the best support available. Proactive approach serves to energize unit members to "take care of their own," thereby correcting potential problems before they can hinder subordinates' effectiveness. Widely recognized for techniques and policies that produce results and build morale. Builds strong family atmosphere. Puts motto <i>Mission first, Marines always, into action.</i>	N/O
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5. COMMUNICATION SKILLS. The efficient transmission and receipt of thoughts and ideas that enable and enhance leadership. Equal importance given to listening, speaking, writing, and critical reading skills. Interactive, allowing one to perceive problems and situations, provide concise guidance, and express complex ideas in a form easily understood by everyone. Allows subordinates to ask questions, raise issues and concerns and venture opinions. Contributes to a leader's ability to motivate as well as counsel.

ADV Skilled in receiving and conveying information. Communicates effectively in performance of duties.	Clearly articulates thoughts and ideas, verbally and in writing. Communication in all forms is accurate, intelligible, concise and timely. Communicates with clarity and verve, ensuring understanding of intent or purpose. Encourages and considers the contributions of others.	Highly developed facility in verbal communication. Adept in composing written documents of the highest quality. Combines presence and verbal skills which engender confidence and achieve understanding irrespective of the setting, situation, or size of the group addressed. Displays an intuitive sense of when and how to listen.	N/O
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A <input type="checkbox"/>	B <input type="checkbox"/>	C <input type="checkbox"/>	D <input type="checkbox"/>	E <input type="checkbox"/>	F <input type="checkbox"/>	G <input type="checkbox"/>	H <input type="checkbox"/>
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JUSTIFICATION:

1. Marine Reported On: a. Last Name b. First Name c. MI d. SSN 2. Occasion and Period Covered: a. OCC b. From To

G. INTELLECT AND WISDOM

1. PROFESSIONAL MILITARY EDUCATION (PME). Commitment to intellectual growth in ways beneficial to the Marine Corps. Increases the breadth and depth of writing and leadership aptitude. Resources include resident schools, professional qualifications and certification processes, nonresident and other extension courses, civilian educational institution coursework, a personal reading program that includes (but is not limited to) selections from the Commandant's Reading List, participation in discussion groups and military societies, and involvement in learning through new technologies.

ADV	Maintains currency in required military skills and related developments. Has completed or is enrolled in appropriate level of PME for grade and level of experience. Recognizes and understands new and creative approaches to service issues. Remains abreast of contemporary concepts and issues.	PME outlook extends beyond MOS and required education. Develops and follows a comprehensive personal program which includes broadened professional reading and/or academic course work; advances new concepts and ideas.	Dedicated to life-long learning. As a result of active and continuous efforts, widely recognized as an intellectual leader in professionally related topics. Makes time for study and takes advantage of all resources and programs. Introduces new and creative approaches to service issues. Engages in a broad spectrum of forums and dialogues.	N/O
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A B C D E F G H

2. DECISION MAKING ABILITY. Viable and timely problem solution. Contributing elements are judgment and decisiveness. Decisions reflect the balance between an optimal solution and a satisfactory, workable solution that generates tempo. Decisions are made within the context of the commander's established intent and the goal of mission accomplishment. Anticipation, mental agility, intuition, and success are inherent.

ADV	Makes sound decisions leading to mission accomplishment. Actively collects and evaluates information and weighs alternatives to achieve timely results. Confidently approaches problems, accepts responsibility for outcomes.	Demonstrates mental agility, effectively prioritizes and solves multiple complex problems. Analytical abilities enhanced by experience, education, and intuition. Anticipates problems and implements viable, long-term solutions. Steadfast, willing to make difficult decisions.	Complex problems. Seldom matched analytical a	N/O
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A B C D E F G H

3. JUDGMENT. The discretionary aspect of decision making. Draws on core values, knowledge, and personal experience to make wise choices. Comprehends the consequences of contemplated courses of action.

ADV	Majority of judgments are measured, circumspect, relevant, and correct.	Decisions are consistent and uniformly correct, tempered by consideration of their consequences. Able to identify, isolate and assess relevant factors in the decision making process. Opinion's sought by others. Subordinates personal interests in favor of impartiality.	Decisions reflect exceptional insight and wisdom beyond this Marine's experience. Counsel sought by all; often an arbiter. Consistent, superior judgment inspires the confidence of seniors.	N/O
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A B C D E F G H

JUSTIFICATION:

H. FULFILLMENT OF EVALUATION RESPONSIBILITIES

1. EVALUATIONS. The extent to which this officer serving as a reporting official conducted, or required others to conduct, accurate, uninfated, and timely evaluations.

ADV	Occasionally submitted untimely or administratively incorrect evaluations. As RS, submitted one or more reports that contained inflated markings. As RO, concurred with one or more reports from subordinates that were returned by HQMC for inflated marking.	Prepared uninfated evaluations which were consistently submitted on time. Evaluations accurately described performance and character. Evaluations contained no inflated markings. No reports returned by RO or HQMC for inflated marking. No subordinates' reports returned by HQMC for inflated marking. Few, if any, reports were returned by RO or HQMC for administrative errors. Section Cs were void of superlatives. Justifications were specific, verifiable, substantive, and where possible, quantifiable and supported the markings.	No reports submitted late. No reports returned by either RO or HQMC for administrative correction or inflated markings. No subordinates' reports returned by HQMC for administrative correction or inflated markings. Returned procedurally or administratively incorrect reports to subordinates for correction. As RO nonconcurred with all inflated reports.	N/O
-----	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-----

A B C D E F G H

JUSTIFICATION:

1. Marine Reported On: a. Last Name, b. First Name, c. MI, d. SSN; 2. Occasion and Period Covered: a. OCC, b. From, To

I. DIRECTED AND ADDITIONAL COMMENTS

J. CERTIFICATION

1. I CERTIFY that to the best of my knowledge and belief all entries made hereon are true and without prejudice or partiality and that I have provided a signed copy of this report to the Marine Reported on. _____ (Signature of Reporting Senior) [Date in YYYYMMDD format]

2. I ACKNOWLEDGE the adverse nature of this report and
 I have no statement to make
 I have attached a statement _____ (Signature of Marine Reported On) [Date in YYYYMMDD format]

K. REVIEWING OFFICER COMMENTS

1. OBSERVATION: Sufficient Insufficient; 2. EVALUATION: Concur Do Not Concur

3. COMPARATIVE ASSESSMENT: Provide a comparative assessment of potential by placing an "X" in the appropriate box. In marking the comparison, consider all Marines of this grade whose professional abilities are known to you personally.	DESCRIPTION	COMPARATIVE ASSESSMENT
	THE EMINENTLY QUALIFIED MARINE	<input type="checkbox"/>
	ONE OF THE FEW EXCEPTIONALLY QUALIFIED MARINES	<input type="checkbox"/>
	ONE OF THE MANY HIGHLY QUALIFIED PROFESSIONALS WHO FORM THE MAJORITY OF THIS GRADE	<input type="checkbox"/>
	A QUALIFIED MARINE	<input type="checkbox"/>
	UNSATISFACTORY	<input type="checkbox"/>

4. REVIEWING OFFICER COMMENTS: Amplify your comparative assessment mark; evaluate potential for continued professional development to include: promotion, command, assignment, resident PME, and retention; and put Reporting Senior marks and comments in perspective.

5. I CERTIFY that to the best of my knowledge and belief all entries made hereon are true and without prejudice or partiality. _____ (Signature of Reviewing Officer) [Date in YYYYMMDD format]

6. I ACKNOWLEDGE the adverse nature of this report and
 I have no statement to make
 I have attached a statement _____ (Signature of Marine Reported On) [Date in YYYYMMDD format]

L. ADDENDUM PAGE

ADDENDUM PAGE ATTACHED: YES

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APPENDIX B. OMITTED COMPARATIVE MODELS

	Model A		Model B	
	Dependent Variable = avgPI after		Dependent Variable = avgΔPI	
	Coeff (β)	p-value	Coeff (β)	p-value
Intercept	4.69347**	.0001	0.36998**	.0001
Treatment variable				
PME	-0.02811**	0.6938	0.06703*	0.5137
Non PME	0.02082	0.7414	-0.15864*	0.0805
Demographic variables				
nonwhite	-0.21951	0.0009	-0.26120**	0.0061
female	0.09673	0.4394	0.02392	0.8941
married	0.04739	0.4018	-0.06323	0.4363
Cognitive variables				
-----	-----	-----	-----	-----
-----	-----	-----	-----	-----
Affective variables				
Combat	0.10016**	0.0321	-0.03585	0.5930
O3	-0.52425**	.0001	0.11898**	0.1039
O5	0.30983	.0001	0.27124	0.0020
	N = 964		N = 964	
	F-stat = 36.01**	.0001	F-stat = 3.46**	0.0006
	R-square=0.2317		R-square=0.0282	
**Significant at the .05 level				
*Significant at the .10 level				

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