



NAVAL POSTGRADUATE SCHOOL

MONTEREY, CALIFORNIA

THESIS

**A MARKET TREND ANALYSIS OF THE MARINE CORPS
MUSICIAN ENLISTMENT OPTION PROGRAM (MEOP)**

by

Kyle D. Yakopovich

June 2020

Thesis Advisor:
Second Reader:

Douglas J. MacKinnon
Glenn R. Cook

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REPORT DOCUMENTATION PAGE			<i>Form Approved OMB No. 0704-0188</i>	
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instruction, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188) Washington, DC, 20503.				
1. AGENCY USE ONLY (Leave blank)		2. REPORT DATE June 2020		3. REPORT TYPE AND DATES COVERED Master's thesis
4. TITLE AND SUBTITLE A MARKET TREND ANALYSIS OF THE MARINE CORPS MUSICIAN ENLISTMENT OPTION PROGRAM (MEOP)				5. FUNDING NUMBERS
6. AUTHOR(S) Kyle D. Yakopovich				
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Postgraduate School Monterey, CA 93943-5000				8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES) Marine Corps Recruiting Command, Quantico, VA 22134				10. SPONSORING / MONITORING AGENCY REPORT NUMBER
11. SUPPLEMENTARY NOTES The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government.				
12a. DISTRIBUTION / AVAILABILITY STATEMENT Approved for public release. Distribution is unlimited.				12b. DISTRIBUTION CODE A
13. ABSTRACT (maximum 200 words) Recruiting duty is considered to be one of the most challenging billets within the Marine Corps, and Marines will endure great personal hardship to succeed in accomplishing their mission. A subset of this mission is to recruit applicants for the Marine Corps field bands via the Musician Enlistment Option Program (MEOP). This portion of the recruiting mission is considered one of the most difficult to accomplish. It is also the only mission within Marine Corps enlisted recruiting that requires an exclusively tested skill prior to enlisting. Understanding the demographics of this population is key to the Marine Corps effectively targeting its manpower and advertising resources to recruit well-qualified individuals to serve as Marine musicians. Utilizing data management and software analysis techniques, this study examines those previously recruited via the MEOP by mining historical data obtained from the Marine Corps Recruiting Information Support System (MCRISS). It quantitatively describes the population and identifies significant demographic shifts. After identifying statistically relevant changes, this study provides recommendations on how to improve the MEOP recruiting process for greater effectiveness and efficiency. This study's approach and methodology may be applied to future populations of interest with pre-existing special knowledge, skills, and abilities.				
14. SUBJECT TERMS Marine Corps, MCRC, Musician Enlistment Option Program, MEOP, recruiting, market trend, information management, data management, big data, knowledge skills and abilities, KSA, Enlisted Recruiting Process, ERP, econometrics				15. NUMBER OF PAGES 171
				16. PRICE CODE
17. SECURITY CLASSIFICATION OF REPORT Unclassified		18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified		19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified
20. LIMITATION OF ABSTRACT UU				

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ENLISTMENT OPTION PROGRAM (MEOP)**

Kyle D. Yakopovich
Major, United States Marine Corps
BA, University of Pittsburgh, 2008

Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN INFORMATION TECHNOLOGY MANAGEMENT

from the

**NAVAL POSTGRADUATE SCHOOL
June 2020**

Approved by: Douglas J. MacKinnon
Advisor

Glenn R. Cook
Second Reader

Thomas J. Housel
Chair, Department of Information Sciences

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ABSTRACT

Recruiting duty is considered to be one of the most challenging billets within the Marine Corps, and Marines will endure great personal hardship to succeed in accomplishing their mission. A subset of this mission is to recruit applicants for the Marine Corps field bands via the Musician Enlistment Option Program (MEOP). This portion of the recruiting mission is considered one of the most difficult to accomplish. It is also the only mission within Marine Corps enlisted recruiting that requires an exclusively tested skill prior to enlisting. Understanding the demographics of this population is key to the Marine Corps effectively targeting its manpower and advertising resources to recruit well-qualified individuals to serve as Marine musicians. Utilizing data management and software analysis techniques, this study examines those previously recruited via the MEOP by mining historical data obtained from the Marine Corps Recruiting Information Support System (MCRISS). It quantitatively describes the population and identifies significant demographic shifts. After identifying statistically relevant changes, this study provides recommendations on how to improve the MEOP recruiting process for greater effectiveness and efficiency. This study's approach and methodology may be applied to future populations of interest with pre-existing special knowledge, skills, and abilities.

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LIST OF ACRONYMS AND ABBREVIATIONS

11S	traditional high school senior
12L	traditional high school graduate
42R	United States Army Musician
AFQT	Armed Forces Qualification Test
ASVAB	Armed Service Vocational Aptitude Battery
BAH	basic allowance for housing
BD	Big Data
BLS	Bureau of Labor Statistics
BMC	Basic Music Course
CANDP	Marine Corps Concepts and Programs
CAR	Commander's Attainment Report
CDR	Commander, United States Navy
CG	Commanding General
CKM	Customer Knowledge Management
CNIP	Civilian Non-Institutionalized Population
CO	Commanding Officer
COA	Course of action
CPI	Consumer price index
CRISP-DM	Cross-Industry Standard Process for Data Mining
DEP	Delayed Entry Program
DOD	Department of Defense
DON	Department of the Navy
EBP	Enlisted Bonus Program
ECC	Education Code at Contract
ECS	Education Code at Shipping
EIP	Enlisted Incentive Program
EPM	Enlisted Processing Manual
ERP	Enlisted Recruiting Process
ERR	Eastern Recruiting Region
FC	Frost Call

FY	fiscal year
GAO	Government Accountability Office
HEADS	Higher Education Arts Data Services
HQ	headquarters
HQMC	Headquarters Marine Corps
HSCCP	High School Community College Program
HSG	high school graduate
HSS	high school senior
KSA	knowledge, skills, and abilities
MC3	Marine Corps Consulting and Communication
MCD	Marine Corps District
MCRC	Marine Corps Recruiting Command
MCRD	Marine Corps Recruit Depot
MCREN	Marine Corps Recruiting Enterprise Network
MCRISS	Marine Corps Recruiting Information Support System
MCTFS	Marine Corps Total Force System
MCTIMS	Marine Corps Training Information System
MEOP	Musician Enlistment Option Program
MEPCOM	United States Military Entrance Processing Command
MEPS	Military Entrance Processing Station
MOS	Military Occupational Specialty
MSG	Master Sergeant, U.S. Army
MSgt	Master Sergeant
MTA	Musician Technical Assistant
NCES	National Center for Education Statistics
NRC	Navy Recruiting Command
NRM	Navy Recruiting Manual
NROTC	Naval Reserve Officer Training Course
NSOM	Naval School of Music
ODASD MC&FP	Office of the Deputy Assistant Secretary of Defense for Community and Family Policy
OPT	operational planning team

OSA	Officer Selection Assistant
OSO	Officer Selection Officer
OST	Officer Selection Team
OUSD	Office of the Under Secretary of Defense
PEF	Program Enlisted For
RCT	Recruiter Client Tool
RDBMS	relational database management system
RMC	Regular Military Compensation
ROP	recruiters on production
RS	Recruiting Station
RSS	Recruiting Substation
SDA	Special Duty Assignment
SME	subject matter expert
SMO	Senior Marine Representative
SMSGt	Senior Master Sergeant, U.S. Air Force
SNCO	staff non-commissioned
SNCOIC	staff non-commissioned officer-in-charge
SQL	Structured Query Language
SRI	Systematic Recruiting Inspection
SSN	Social Security Number
SY	school year
TFDW	Total Force Data Warehouse
TIS	time-in-service
U2	Marine Corps field band program enlisted for identifier
USA	United States Army
USAF	United States Air Force
USAREC	United States Army Recruiting Command
USMC	United States Marine Corps
USN	United States Navy
USNB	United States Navy Band
WRR	Western Recruiting Region
XO	Executive Officer

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ACKNOWLEDGMENTS

To begin my acknowledgments, I must first admit that my assignment to Marine Corps Recruiting Command was a cause of concern. I was aware of the daunting reputation associated with recruiting duty and feared that I was not up to the task. The same can be said for my assignment to the Naval Postgraduate School. After reviewing the curriculum I had been assigned to, it was an intimidating challenge for someone with a B.A. in history. Any measure of success I may have had at either place can be directly attributed to the friends, family, and colleagues who helped carry me along the way.

From my time in MCRC I thank my first CO, LtCol Paul Bock, for having such patience with me as his new OpsO, and to Maj Michael Schmitt for showing me how to “read the Matrix” of MCRISS. I also thank my second CO, LtCol Luke Sauber, for his confidence in my abilities and genuine appreciation of my opinions. I thank Maj Michael Bell for the energy he brought to work every day as our XO, a necessary ray of light through the gray clouds that often hung over the “Opstagon.” To MGySgt Michael Nash I am indebted for his mentorship, forthright honesty, and tenacity. To MSgts Patrick McNew and Daniel Harper, thank you for always making shipping happen—something to never be taken for granted. To the unnamed Marines of Recruiting Station Frederick, I am forever humbled by your hard work, dedication, and personal sacrifice—thank you.

To Dr. Douglas MacKinnon, thank you for all of your positive encouragement, and mentorship, and for being exactly the kind of thesis advisor I needed to succeed. I also thank Mr. Glenn Cook for his instruction, advice, and personal concern. To Maj Daniel Sanchez and MSgt James Stanley of MCRC, thank you for making sponsorship of this thesis possible, and for your assistance with my many inquiries.

My greatest thanks is reserved for my wife, Dr. Yvonne Eaglehouse. You graciously endured being used as my sounding board for ideas, assisted as the “third reader” for this thesis, and were vital in helping develop its statistical models. You are professionally accomplished in your own right, remarkably patient with my antics, a loving wife, a wonderfully devoted mother to our beautiful daughter, and my best friend.

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I. INTRODUCTION AND BACKGROUND

A. ORIGIN OF RESEARCH

“In God we trust, all others must bring data.”

This quote is attributed to the American economist, engineer, and industrialist W. Edwards Deming, and captures the essence of operational analysis within Marine Corps recruiting (Kendall, 2017, p. 11). In 2017, the student author of this thesis was the Operations Officer for a Marine Corps Recruiting Station (RS). In May of that year, the RS hosted several senior leaders from a higher echelon of command. During a roundtable discussion about general trends in recruiting, the subject of the Marine Corps Musician Enlistment Option Program (MEOP) came up. The perspective voiced by some of members of the RS’s command team was that it felt as if there had been a significant shift in the market for MEOP prospects away from high schools and toward college-educated individuals, and that this was perceived to be causing an increasing difficulty for the enlisted recruiting force in an already challenging mission subset. In response, one of the senior guests stated something to the effect of “Actually, the data shows that the majority of our applicants are still coming from high schools.” A debate ensued about what “the data” was actually saying and what it really meant, and it ended without anyone feeling overly satisfied with the answers provided.

Frustrated by what appeared to be an incongruity between perception at the tactical level and the reality of what the data was said to be showing, the student author took it upon himself to conduct an informal data-dive to find out for himself what, if any, shifts in MEOP demographics had occurred. However, due to the limits on data availability at the RS echelon of command, the lack of time available for such side projects, and lack of understanding of how to conduct a thorough quantitative analysis that the student author had at the time, he was left with more questions than answers. The issue was shelved and more important matters, like how to achieve the monthly contracting and shipping missions, consumed his time instead.

When the student author arrived at the Naval Postgraduate School in July 2018, he sat in a briefing to all new Marine students given by the Senior Marine Representative (SMO). In that brief, the SMO rhetorically asked the audience if they ever had a burning thought or question in a previous billet that they did not have the time, resources, or knowledge to answer. After asking this question the SMO turned to the audience and said something to the effect of “Here, you have the time. Finish the thought, answer the question.”

While prior internal research of MEOP recruiting has been conducted by the Marine Corps Recruiting Command (MCRC), to date there does not appear to have been a rigorous application of data management strategies and statistical analysis to help answer the question of “Have there been any significant shifts in the MEOP population that require MCRC to reevaluate its recruiting strategies and methodologies?” The goal of this research is to finish answering the question that was asked by the student author in 2017, and has undoubtedly been asked by many others in similar situations. With the assistance of MCRC in providing access to the data necessary to conduct this study, and with the assistance of those at MCRC who supported this study along the way, the research team believes they have done their part to answer the question. While the Musician Enlistment Option Program is a relatively small part of MCRC’s overall mission, it is also amongst the most unique and can be quite difficult to achieve. Even a small pebble inside of a boot makes for a difficult hike. Without an understanding of the pre-enlistment demographic profile of those who enlist as a Marine musician, knowing how to most effectively prospect for them is a greater challenge.

B. MARINE CORPS RECRUITING COMMAND ORGANIZATION

1. Marine Corps Recruiting Command Organizational Structure

The Marine Corps Recruiting Command is headquartered in Quantico, VA, and is commanded by a Major General. The next echelon of command below MCRC headquarters are two regional commands, the Eastern Recruiting Command (ERR) and Western Recruiting Command (WRR). Each region is commanded by a Brigadier General. Each region is divided into three Marine Corps Districts (MCD), each being

commanded by a Colonel. Each MCD is divided into several Recruiting Stations (RS), commanded by a Major.

The RS is the lowest echelon commanded by a commissioned officer, is the lowest echelon of command with a typical Marine Corps headquarters command structure, and is the lowest echelon of command directly responsible for both enlisted and officer recruiting missions. Each RS is subdivided into several Recruiting Substations (RSS) that are commanded by a noncommissioned officer or staff noncommissioned officer, which are responsible for the RSS's enlisted recruiting mission. Each RSS is subdivided into Permanent Contact Stations and Temporary Recruiting Facilities (Marine Corps Recruiting Command [MCRC], 2016). These offices are manned by one or several Marine recruiters, who are directly responsible for prospecting and recruiting efforts. These Marines are referred to as recruiters on production (ROP) (MCRC, 2016). Each recruiter is assigned a sector in which they prospect, and these sectors are assigned by zip code. Recruiter sectors are in part governed by the fair share concept, meaning each recruiter theoretically has an equitable share of the eligible population from which to prospect compared to the size of their assigned mission (MCRC, 2016).

Recruiting Stations are also in charge of one or more Officer Selection Stations (OSS), which are administered by an Officer Selection Officer (OSO) and Officer Selection Assistants (OSA), referred to together as the Officer Selection Team (OST). The OSO is typically a company grade officer, while the OSAs are enlisted recruiters. The OST is responsible for achieving the RS's annual officer candidate mission. According to an email from a MCRC representative dated October 25, 2019, the FY20 manning levels for MCRC were 3,763 total recruiters, 2,345 recruiters on production, and 74 OSOs. Figure 1 shows the enlisted command structure of MCRC for FY 2019, which was not appreciably different from FY 2020.

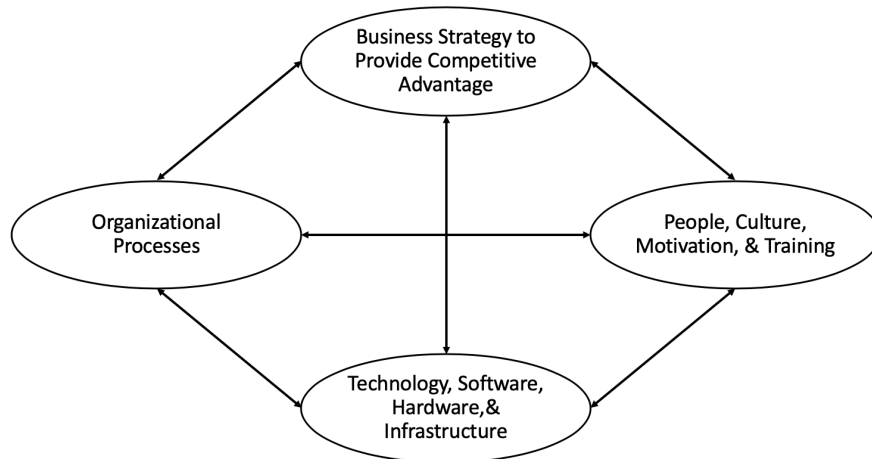


Figure 2. Leavitt's Diamond. Adapted from Leavitt (1965).

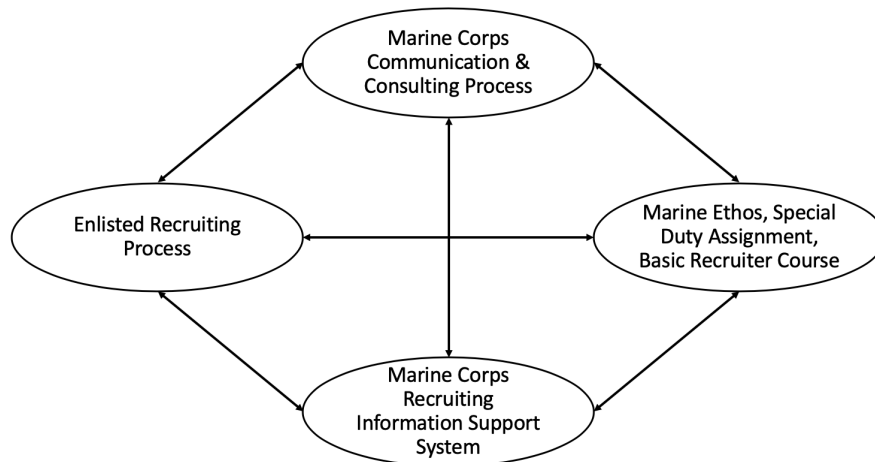


Figure 3. Leavitt's Diamond applied to MCRC. Adapted from Leavitt (1965).

a. Business Strategy and Organizational Processes

The Marine Corps Communication and Consulting (MC3) process is the strategy MCRC uses to gain the commitment of potential applicants, and is visually depicted in Figure 4 (Marine Corps Recruiting Command [MCRC], 2011). Recruiters are trained in the use of MC3 strategies in order to gain and maintain the commitment of applicants, and it is an essential part of what MCRC refers to as “systematic recruiting” (MCRC,

2016). MC3 strategies and tactics are closely related to MCRC's Enlisted Recruiting Process (ERP). The ERP can be thought of as the internal business practices and processes to recruit future Marines.

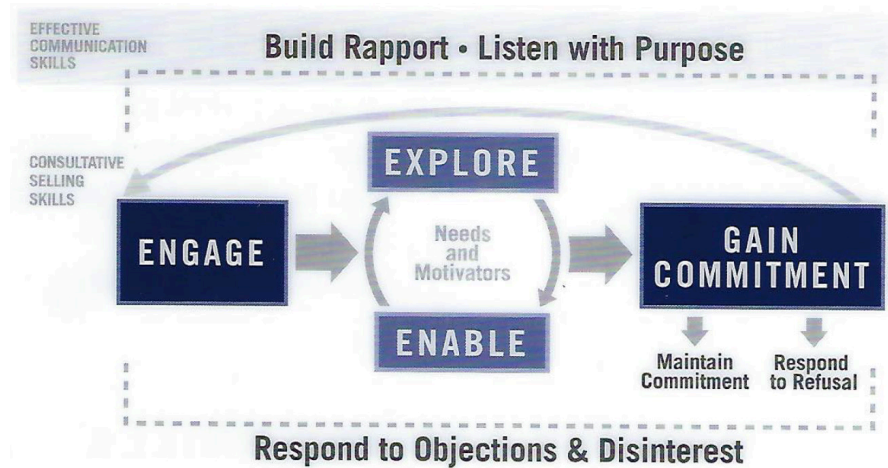


Figure 4. The Marine Corps Communication and Consulting process.
Source: MCRC (2011).

In order to have a firm understanding of MEOP recruiting processes, it is necessary to understand the ERP. While Figure 5 depicts the ERP as an eight-step linear process, it can also be conceptualized as a self-reinforcing positive feedback loop, as shown in Figure 6 (Sternman, 2000). When a recruiter gains the applicant's commitment and they are found qualified to enlist, they are typically sworn into the Delayed Entry Program (DEP) until their scheduled date to "ship" to a Marine Corps Recruit Depot (MCRD). The DEP serves as a "pool" of future recruits, thus those in the DEP are referred to as "poolees" (MCRC, 2016, p. 1-3). While in the DEP poolees discuss their preferences and an MOS is assigned to them based on qualifications and availability.

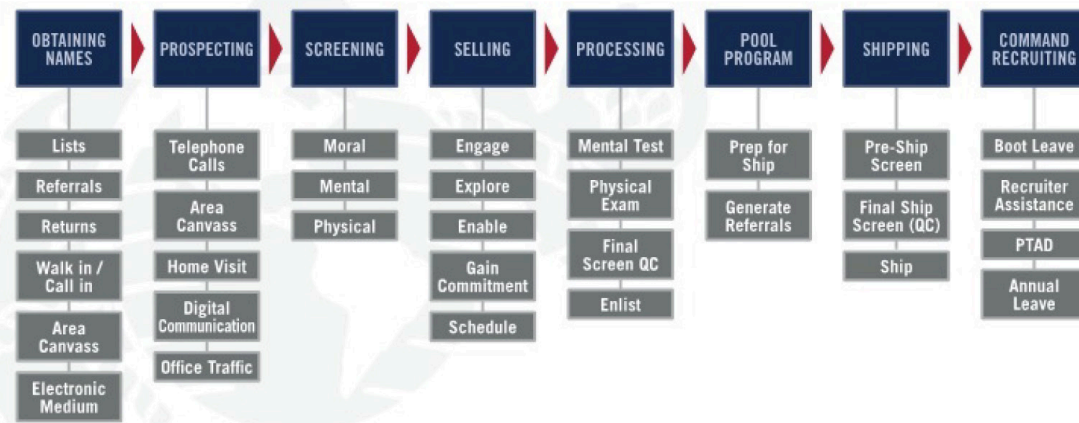


Figure 5. The enlisted recruiting process. Source: MCRC (2014a).

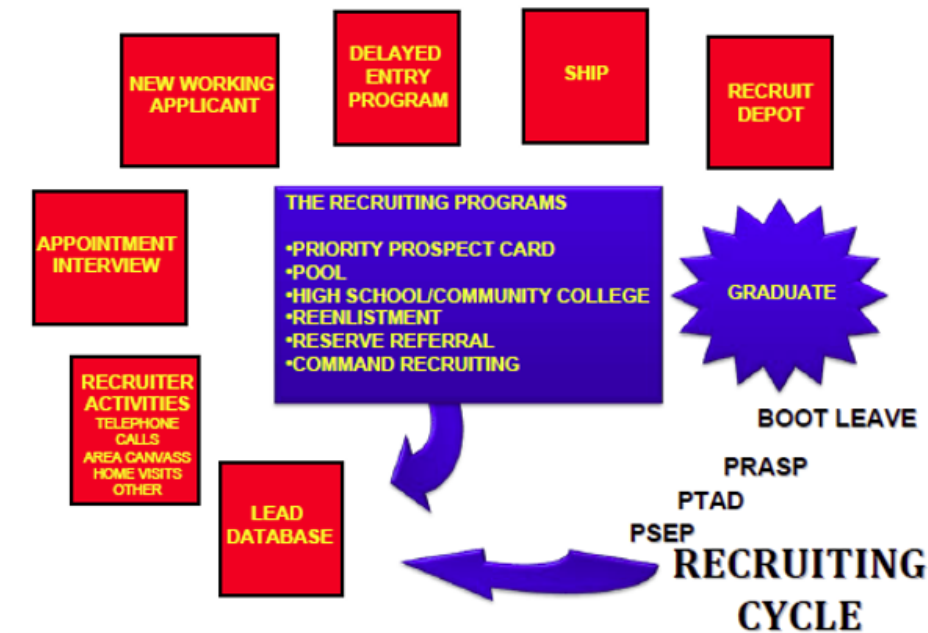


Figure 6. The recruiting cycle. Source: Choike and Zeliff (2010).

MCRC considers most important step of the ERP to be shipping. The RS CO's primary mission is "to ensure the RS achieves assigned shipping requirements" (MCRC, 2016, p. 3-1). The difference between contracting and shipping was said to be that contracting was MCRC's "internal tool for managing shipping goals in future months and

years” while shipping has a direct impact total force end strength (Griesmer, 2006, p. 47). Furthermore, “in operational terms, accession [i.e, shipping] are current operations whereas contracting is future operations” (Griesmer, 2006, p. 47). Accordingly, a Recruiting Station receives no credit toward its MEOP mission until the poolee ships. Every initial accession attends a 13-week recruit training program regardless of MOS or previous enlistments in another armed service, the exception being the Marine Corps’ President’s Own band (Headquarters Marine Corps [HQMC], 2018a). Given MCRC’s emphasis on *shipping* as opposed to *contracting*, this study’s data collection from the MCRIS database focused on those shipped each fiscal year and not on those contracted by fiscal year, since it is ultimately a shipping mission that MCRC must obtain annually. Contracting is the enabler of shipping. As the student author’s former CO was apt to exclaim when comparing shipping to contracting, “Shipping is king!”

(1) High School and Community College Program

An integral part of the Enlisted Recruiting Process as it relates to MEOP recruiting is the High School and Community College Program (HSCCP). The Guidebook for Recruiting Operations states “all of the major recruiting programs are important, but the High School/Community College Program is the cornerstone of your recruiting efforts” (MCRC, 2016, p. 6-6). The HSCCP enables recruiters to employ their MC3 skills and utilize the ERP to target one of MCRC’s prime demographic markets - high school seniors.

The RS Executive Officer (XO) is the program manager for the HSCCP, complimenting their status as the program manager for MEOP recruiting (MCRC, 2016). The XO oversees the program for each working school in the RS’s area of operations. A working school is defined as having a sufficiently large mentally qualified population of high school seniors, where recruiters have access to the students, and the school’s contracting history justifies a continued presence (MCRC, 2016, p. 6-10). The HSCCP band talk requirement is completed in every working school within the RS area of operations that offers a music instruction program. “These talks lay the important groundwork for prospecting in the demanding MEOP market” (MCRC, 2016, p. 6-14).

b. Technology

The technology pillar of MCRC's enterprise architecture includes the Marine Corps Recruiting Information Support System (MCRISS). MCRISS is a ubiquitous platform within MCRC and is interwoven into the business processes of the ERP. Every step of the ERP (as shown in Figure 1) is cataloged by the recruiter into MCRISS and used for future reference and data analysis. What was once recorded with paper and pencil and stored in filing cabinets now resides entirely in the MCRISS relational database management system (RDBMS). For better or for worse, it can be said that "if it isn't in MCRISS, it doesn't exist." MCRISS "serves as the Marine Corps' authoritative data source for accession data" and "provides recruiting functionality to track the processing of applicants from contact to shipping and beyond" (Marine Corps Concepts and Programs [CANDP], n.d., MCRISS). MCRISS also interfaces with external systems such as the Marine Corps Total Force System (MCTFS), the Total Force Data Warehouse (TFDW), and the Marine Corps Training Information Management System (MCTIMS), and the software used by the Military Entrance and Processing Command (MEPCOM) (CANDP, n.d.).

MCRISS was described by the Marine Corps as enabling command and control efforts across distributed locations across the country and that it "enables demographic and market analysis to optimize the performance of the recruiting force" (CANDP, n.d., MCRISS). To access the historic accession data stored on the MCRISS database, there is a query tool application that allows the user to specify the size and scope of the data being sought via a Structured Query Language (SQL) graphical user interface (GUI) (MCRC, 2019a). A discussion of how MCRISS was utilized for this research appears in Chapter III.

c. People, Culture, Motivation, and Training

Finally, there are the people of MCRC, arguably the most critical component of the system. The Marines of MCRC are comprised of those specially selected for recruiting duty by the Marine Corps' Special Duty Assignment (SDA) process. Officers selected for duty at the RS level are chosen by competitive selection boards, while

officers in leadership positions at higher echelons of command typically have previous experience on recruiting duty. Recruiting duty is viewed by many as potentially the most difficult peacetime assignment a Marine can have, and is also considered to be career enhancing for those who successfully complete their tour of duty. Additionally, there are opportunities for meritorious promotion, awards, and special recognition for outstanding performers. Some Marines apply for designation as career recruiters, and are accepted for designation as such based on their overall performance as a recruiter and leader of Marines. These Marines are essentially MCRC's organizational memory and serve as its wellspring of experience and knowledge while providing institutional stability. Marines assigned to recruiting duty all receive extensive training, the most common course being the Basic Recruiter Course (BRC) that all enlisted recruiters must graduate from before reporting for duty to their RS.

C. MARINE CORPS MUSICIAN ENLISTMENT OPTION PROGRAM

1. Marine Corps Field Bands Mission, Size, and Structure

The official mission of the Marine Corps' bands are to:

Provide musical support for ceremonies, functions, and other occasions aboard military installations and throughout the civilian community as may be directed by proper authority in order to improve morale, inspire, motivate, and instill in the audiences, a sense of pride and patriotism, and to re-affirm our core values, customs, and traditions, and best represent the United States Marine Corps. (Headquarters Marine Corps [HQMC], 2013)

Each of the ten field bands exist under the operational control of the major command they are attached to, and the commanding general of each of these commands determine "the size of each band's area of responsibility for performing events, which the guidance defines as the geographic area in which an installation, its units, and personnel have an economic and social impact" (Von Ah, 2017, p. 20). Eight bands are located within the continental United States, one is in Kaneohe Bay, HI, and one is stationed in Okinawa, Japan (United States Marine Corps [USMC], n.d.).

The Marine Corps field bands are unique compared to sister service bands in that they are deployable for the purpose of providing perimeter security in combat zones (Von

Ah, 2017). Marine field bands are the only service bands whose mission when deployed to a combat environment is not to provide music (Von Ah, 2017). Marine musicians “patrol dangerous Baghdad streets, protect convoys and man security posts at forward operating bases” (Bedwell, 2008, p. 23). While Marine musicians take pride in their potential combat role, trading a musical instrument for a rifle can be a difficult selling point for potential applicants (Bedwell, 2008). Bedwell noted that “most exceptional students aspire to a future in a symphony or popular jazz groups” and that their mentors encourage this despite a “ruthlessly competitive market” (Bedwell, 2008, p. 25).

MCRC is tasked each fiscal year with shipping a certain number of poolees to recruit training under a U2 PEF (the code used to identify field band musicians jobs in MCRISS). This mission is typically subdivided to each Region, District, and Recruiting Station based on the “fair share” concept. This is based on the number of recruiters each command has, which is in part based on the size of their Civilian Non-Institutional Population (CNIP) ages 17–22 (MCRC, 2017, p. 4-2). Other factors that go into apportioning missions for subcommands include “target market predictors” that use “multi-regression analysis” to model ASVAB outcomes within zip codes, as well as data regarding historical production levels (MCRC, 2017, p. 4-2).

2. Requirements for MEOP Enlistment

To enlist into the Marine Corps, an applicant must score at least a 31 AFQT (Armed Forces Qualification Test) on the Armed Services Vocational Aptitude Battery (ASVAB) (Marine Corps Recruiting Command [MCRC], 2014). To be eligible for a MEOP contract the applicant must achieve a score of at least 50 AFQT and a General Technician (GT) sub-score of 100 (Headquarters Marine Corps [HQMC], 2012). Prior to the publication of an updated scoring scale on in 2017, MEOP applicants were required to perform an audition before the District MTA or other qualified musician screener and achieve a minimum score of 2.7 on a 4.0 scale to qualify for a MEOP contract, and a score of 3.0 for advanced qualification status (HQMC, 2012). New audition grading metrics were changed to a 36-point grading scale. Under this rubric, a score of 18 was considered qualifying, and a score of 24 qualified an applicant for advanced qualification

status (Naval School of Music [NSOM], 2017). The benefits of an advanced qualification include preferential duty station location selection and exemption from attending Naval School of Music’s Basic Music Course (BMC).

Recorded passing auditions are reviewed by the Marine representatives at the Naval School of Music for quality control purposes. This study did not attempt to understand the musical theory that encompass audition standards, as it is outside the purview of the authors’ professional abilities to evaluate. All basically qualified MEOP enlistees must complete the BMC at the NSOM, where both Marines and Sailors receive initial and follow-on musical training. Table 1 shows grading requirements for both Sailors and Marines enrolled in BMC.

Table 1. Grade comparison chart. Adapted from Naval School of Music (2017).

	Navy		Marine Corps	
	4.0 Grading Scale	36 Point Grading Scale	4.0 Grading Scale	36 Point Grading Scale
BMC Incoming	2.30	8	2.30	8
BMC Mid Term	2.70	18	2.50	12
BMC Final	2.85	21	2.70	18

3. Marine Corps Districts and the Musician Technical Assistant

The billet of Musician Technical Assistant (MTA) is comprised of Marine musicians who are “selected to serve as music program managers for each of the [Marine Corps’] six recruiting districts” (Bedwell, 2008, p. 24). “The primary mission of the MTA is to assume overall cognizance for the coordination and management of the MEOP at the District level and provide guidance, operational support, audition screening, implementation and QC [quality control] for the MEOP at all command levels” (MCRC, 2017, p. 3-64). The MTA is tasked with “maintaining continuous liaison with the RS XO, officer selection officer (OSO), and Staff Non-Commissioned Officer-in-Charge (SNCOIC) in pursuit of RS and MCD MEOP mission obtainment” (MCRC, 2017, p. 3-64).

The MTA is tasked with performing market analyses and integrating MEOP recruiting efforts into the annual District Operations Plan (MCRC, 2017). The MTA is to develop an annual plan that integrates the HSCCP with local colleges and universities, although there is not any specific guidance on what that directive entails (MCRC, 2017). Specificity in how MTAs execute their prospecting plans at the District level and how the MTA interacts with the Recruiting Stations in their area of operations are found in each District's annual operations order, which will inherently differ from one another based on the scheme of maneuvers conceived by each District's command.

The MTA is tasked to work with the RS Officer Selection Officers (OSO) to coordinate prospecting on college campuses, however the only mentions of the words "band," "MEOP," or "music" within the Guidebook for Officer Selection Officers is the passing reference of "consider other key individuals on campus such as those affiliated with the campus' rec sports, the campus gym, ROTC units, the band (to provide contacts for enlisted recruiters), etc." (MCRC, 2015b, p. 19-2). A result of the 2015 MEOP Operational Planning Team (OPT) Conference was a direction to OSTs to request listings of musicians from their universities in order to facilitate targeted mail-out advertisements, and to share these lists with the enlisted recruiting force for further prospecting (MCRC, 2015a).

Districts also organize and sponsor an annual Music Educators Conference where music educators and band directors in local music programs are invited to attend what is typically a five-day event held in Norfolk, VA and northern Virginia. Participants are usually exposed to the Naval School of Music, the Quantico Marine Corps Band, the national Marine Corps Museum, the Drum & Bugle Corps (Commandant's Own) and/or the United States Marine Corps Band (President's Own), and an evening parade ceremony at the Marine barracks located at 8th & I Street in Washington, D.C., This study's point of contact within MCRC, MSgt Stanley, stated that while this is an expensive endeavor, feedback from participants is well received, and is considered to be one of MCRC's best outreach programs for the Marine Corps Music Program.

4. MEOP Prospecting at the Recruiting Station Level

It is not typical to see MEOP missions assigned below the RS level to the substation (RSS) level, although many RSs require a quota of MEOP screening forms from their RSSs to encourage prospecting qualified MEOP applicants (MCRC, 2016). The annual quota for each instrument is based on projected openings in each fleet band's table of organization. These instrument quotas are typically divided and assigned down to the District level, and specific instruments are typically not missioned to individual RSs. While not a prescriptive method, Districts may assign a point-value per instrument metric, and then assign each RS with a point-value mission (MCRC, 2017). Missioning for the RSs may also be as simple as instrument availability on a first-come, first-serve basis for the first qualified applicant an RS provides. Assigning MEOP missions is generally based on the previously discussed "fair share" concept and does not account for concentrations of known musical talent in different regions, high schools, or universities. It also does not weight the comparative talents of prospective musicians against one another, and availabilities are generally filled on a "first to qualify, first to contract" basis.

Since the XO is the program manager for the MEOP at the RS level, that Command Group member is inherently the main effort for coordinating prospecting for MEOP applicants for each RS (MCRC, 2016). The RS XO was made the MEOP program manager after changes made to the MEOP program in 2015, and must report progress to the RS CO on no less than a monthly basis (MCRC, 2016). The RS XO is expected to work closely with the District MTA to prospect for, audition, and ultimately contract qualified musicians. The RS XO also tracks and enforces high school band talk milestone attainment, a complimentary role to their status as the manager for the HSCCP. In the student author's professional opinion, the health of an RS's MEOP program may be directly correlated to the personal tenacity of the XO in managing the program, the quality of music programs that exist in local high schools and universities, and the XO's ability to penetrate those programs and develop fruitful working relationships.

The distributed missioning for instruments to each District and the first-come, first-serve system in which Recruiting Stations fill District quotas means that while the

Marine Corps may be meeting its annual accession requirements, it may not be doing so in the most efficient manner for the recruiting force and may not be providing the highest quality applicant available per instrument. The marginally qualified flute player in Idaho may enlist because it fulfills an essential mission requirement for that respective RS and MCD, while an exceptionally qualified flute player graduating from The Julliard School in New York may not be able to enlist due to there simply not being an available flute slot within that District. Furthermore, while a RS or MCD may have several qualified musicians, they still risk missing their annual mission if those instruments do not align with their assigned instrument quotas. This may result in RSs and MCDs cajoling and “horse trading” to make mission, or simply having to turn away exceptionally qualified applicants because there is no availability for their instrument.

This study’s MEOP subject matter expert at MCRC stated in an April 29, 2020, phone conversation that these sorts of issues have been exacerbated in recent fiscal years when annual U2 missions have been historically low, annual missions are being made earlier in the year, “start pools” for the following year are filling before known vacancies are even identified, and the quality of applicant has been exceptionally high. While these are “good” problems to have from a mile-high perspective, it may compound the stressors put on the lower echelons of command competing to fill slots in a “musical chairs” system of mission assignments and vacancy filling.

Beyond the unique qualities outlined for musician missioning, the methodology used by RSs to achieve their MEOP mission is rooted in the MC3 and ERP processes. The MEOP program is closely related to the HSCCP at the RS level, and the HSCCP is considered the “cornerstone” of an RS’s recruiting efforts. (MCRC, 2016, p. 6-6). A component of RS prospecting for MEOP applicants are the high school band talk requirements for every working school with an active band program. In an email dated April 28, 2020, MSgt Stanley wrote that a high school band talk “also provides that recruiter an audience consisting of the largest collective gathering of Alphas in that school.” An Alpha is an individual who scores at least 50 AFQT on the ASVAB (MCRC, 2014). MSgt Stanley’s unsolicited opinion was that “band talks provide the canvassing

recruiters an opportunity to talk about the Marine Corps while using the MEOP as a proof source of just one of many opportunities.”

Additionally, MSgt Stanley stated that while few qualified musicians are found through the conduct of high school band talks, the band talks provide the benefit of exposing opportunities available to the Marine Corps to a captive audience, and that finding a qualified MEOP applicant via a high school band talk is more of a “residual benefit” instead of the main objective. This mindset aligns with a phrase often heard in MCRC that states “first to contact, first to contract,” meaning that MCRC values early exposure to prospective applicants in order facilitate future enlistment, even if it is several years later. While the MEOP mission is under the umbrella of enlisted recruiting, and enlisted recruiting’s aimpoint is predominately on the high school market, a 2008 article about MEOP recruiting stated:

Few high school musicians can meet the high standards of today’s bands. ... Therefore, even though MTAs [Musician Technical Assistant] consider it important to plant the idea of a Marine band career early in high school students, they spend more time canvassing college music programs to find those who can qualify through MEOP. Colleges and universities remain the MTA’s main market for scouting talent. (Bedwell, 2008)

5. Monetary Incentives for MEOP Enlistment

MEOP applicants are given additional incentives in addition to those available to other enlistees. While 2.7/4.0 (18/36) is the minimum passing audition score, a score of 3.0 (24) is considered exceptionally qualified and qualifies them for assignment to the field band location of their choice (HQMC, 2012). All field band enlistees may be promoted to a grade of E-4 after 24 months’ time-in-service (TIS), while those possessing a bachelor’s degree may be awarded E-5 within 36 months TIS (HQMC, 2012). In FY20 the Marine Corps Enlistment Incentive Program offered MEOP enlistees a \$6,000 bonus (Manpower & Reserve Affairs [M&RA], 2019). Of the eight specialty jobs being offered monetary incentives in FY20, MEOP ranked third highest (M&RA, 2019). This \$6,000 amount for MEOP was consistent dating back to FY13, while in FY11 and FY12 it was \$7,500 (M&RA, 2011) (M&RA, 2011a).

D. PROBLEM STATEMENT

Recruiting duty is considered to be one of the most challenging and time-consuming peacetime jobs within the Marine Corps, and is a critical mission that Marines will endure great personal and professional hardships to achieve. Part of Marine Corps Recruiting Command's mission is to recruit applicants for the Marine Corps field bands via the Musician Enlistment Option Program. This small portion of the already challenging enlisted recruiting mission is considered to be one of the most difficult missions to accomplish, and is the only mission within Marine Corps enlisted recruiting that requires an exclusively tested skill prior to enlistment. While research has been conducted into other areas related to the enlisted recruiting mission, no formal academic research has been conducted into the demographic qualities of those recruited for the MEOP. A thorough descriptive quantitative analysis of historical contracting data may assist MCRC leadership to better understand the characteristics of those enlisted into the Marine Corps' field bands, and identify any unrecognized market shifts that may have occurred over the past decade. Without this information, MCRC risks inefficiently allocating its monetary and manpower resources, which would be to the detriment of mission accomplishment and recruiter quality of life.

E. PURPOSE STATEMENT

The purpose of this study is to conduct a descriptive quantitative analysis of historical recruiting data for those enlisted into the Marine Corps' field bands via the MEOP, from a logical positivism perspective. The data for this study was queried from the Marine Corps Recruiting Information Support System database. The focal point of this research is analyzing trends in education level at time of contracting for MEOP applicants. Additional variables such as Armed Services Vocational Aptitude Battery scores, age at time of enlistment, and time in the Delayed Entry Program are also analyzed. Computer-based decision support and statistical analysis software coupled with information management concepts are utilized to sort, structure, and analyze the data set. This study's process of quantitative description and analysis forms the basis for recommendations to improve MEOP recruiting effectiveness and efficiency and will

enable MCRC to make better informed decisions regarding MEOP performance standards, advertising strategies, and recruiting methodologies.

F. RESEARCH QUESTIONS

The following questions are the focus of this research:

1. How do we identify any statistically relevant market shifts within the MEOP population?
2. What statistically relevant market shifts have occurred in the population recruited for the MEOP over the last 15 years?
3. What recommendations can be made to MCRC to improve its effectiveness and efficiency in recruiting qualified applicants for the MEOP?

G. RESEARCH BENEFITS AND LIMITATIONS

This research provides a detailed understanding of the MEOP field band population from a demographic analysis perspective, which will enable recruiting leadership to make better informed decisions regarding musician performance standards, enlistment standards, enlistment incentives, recruiting techniques, and advertising strategies. These benefits lead to a greater efficiency in time and effort allocation for recruiters while providing the Marine Corps Music Program the quality applicants it requires to fulfill its mission. The student researcher has operational experience garnered from his time as the Recruiting Station Frederick, Maryland, Operations Officer from September 2015 through May 2018. After successfully completing this tour of duty he was assigned a military occupational specialty (MOS) of 4802, “Recruiting Officer, Operational Expert” (Headquarters Marine Corps [HQMC], 2018a). Given this, the student author’s experience is sometimes relied on to provide context, meaning, and unique perspectives.

Potential limitations of this research are that it only considers historical data obtained from the MCRIS database. This study is limited to the subject of field band

recruitment, and not retention. This study does not consider the entire life cycle of MEOP enlistments from other databases such as the Total Force Data Warehouse or the Marine Corps Total Force System, as the research team deemed querying that data unnecessary to answer the primary research questions. Additionally, the research team of this thesis were unable to obtain useful datasets from the Naval School of Music that could be adequately integrated into the primary dataset from MCRISS. Other limitations are governed by the nature of the time-series and statistical analyses. While identified relationships may have statistical significance, the methods used to identify them by no means provide definitive causal answers to trends that may be occurring within the market. Further research is required to investigate any potential causal relationships identified by this research. This research does not conduct qualitative inquiries of factors that influence applicants to enlist as a Marine musician beyond what can be quantitatively described.

This research is limited to studying a market trend analysis of those who enlist into the Marine Corps field bands under the MEOP with a PEF (Program Enlisted For) of U2. It does not conduct an analysis of those who enlist into the Marine Corps Drum & Bugle Corps, otherwise known as the “Commandant’s Own” (PEF U4), or the premier band known as the “President’s Own” (PEF U1). The reason for this is that each of these subsets of the Marine Corps Music Program have different audition requirements that may skew this study’s analysis of the larger U2 population, and that the small cohort size of the Commandant’s Own and President’s Own did not lend themselves to stand-alone statistical analysis. The President’s Own is also recruited in a manner different than was discussed for U2 and U4 field band musicians, and falls outside of the regular enlisted recruiting mission for this study’s purposes.

H. METHODOLOGY

The data for this study was obtained by accessing the MCRISS RDBMS via the MCRISS Query Tool application on a laptop lent to the student author by MCRC. Queries were structured to access the years covering FY 2005 through FY 2019 for applicants who enlisted with a PEF code of U2. The data collected represents the entire

population of Marines shipped to recruit training under the U2 PEF for the time period queried. The demographic attributes included in the query ensure that there was sufficient information to address this study's research questions. Questions regarding quantitative demographic information requests outside of MCRISS were managed by the subject matter expert at MCRC, who acted as the main point of contact within MCRC and the NSOM. Data was solicited by the student author from representatives of the Army, Navy, and Air Force music programs and recruiting services. Requests for information were limited to aggregated quantitative and descriptive information that service representatives were willing to share, and did not solicit opinionated or qualitative responses.

Microsoft Excel was exclusively used to perform all data manipulation and data analysis for this research. This allows this study's methods and models to be replicated and verified on any government-issued computer that has a standard software package installed. The methods used for mining, cleaning, modeling, and analyzing the primary dataset are discussed in detail in Chapter III.

I. THESIS ORGANIZATION

Chapter I of this thesis discusses the origin of research, the organizational structure of MCRC and an overview of the Marine Corps Musician Enlistment Option Program. Chapter II conducts a literature review of topics pertinent to this thesis. Chapter III discusses the methodology used to shape the primary dataset and provides descriptive statistics. Chapter IV conducts an analysis of select variables highlighted in Chapter III. Chapter V provides interpretations of the results found in Chapter IV, includes suggested courses of action, and concludes with future considerations for research.

II. LITERATURE REVIEW

A. PREVIOUS RESEARCH ON USMC MEOP MARKET TRENDS

Previous research found on MEOP market trends came from a June 2015 MCRC-sponsored Operational Planning Team (OPT). The purpose of the OPT was to “discuss ways to improve MEOP recruiting effectiveness and program management while raising overall audition performance of Marine musicians at the Naval School of Music...” It stated that “a comprehensive review of the program [has] not been convened since the inception of the program in 1993” (MCRC, 2015a, p. 1). Findings of the study were presented at the 2015 MCRC Executive Leadership Conference (Marine Corps Recruiting Command, [MCRC] 2015).

The OPT concluded that the majority of MEOP applicants were contracted during their senior year of high school (categorized as an 11S), or after graduation but before college (12L). The OPT noted that from FY05 to sometime in FY15, 81% of MEOP contracts were education code “11S” or “12L” at time of contracting. The study also stated that there had been a noticeable shift to those having one semester or more of college over the previous five years, having been 15% from FY05-FY10 and 28% from FY11-FY15 (MCRC, 2015). While informative, this data was not scrutinized for statistical significance. The OPT reached the conclusion that most Marine musicians “were high school seniors when they joined followed by those going to college [and] then those that had a bachelor’s degree” (MCRC, 2015, p. 38). The OPT stated that there was a “very close split” between the portion of high school seniors and high school graduates contracted from FY 2005 through their data cutoff point sometime in FY 2015 (MCRC, 2015, p. 38).

The results of the study led to the Commanding General of MCRC to approve a four-phase course of action to improve recruiting effectiveness and performance outcomes at the Naval School of Music. Phase 1 was to produce “uniform guidance regarding MEOP mission planning, roles, responsibilities, market expansion and training” (MCRC, 2015a, p. 1). Phase 2 involved planning timelines to address changes

to recruiting doctrine publications. Phase 3 convened working groups for revising training and doctrine volumes, updating marketing and advertising materials, and improving quality control measures. Phase 4 was to incorporate recommended changes into official doctrine and conduct a national MTA conference. A standardized MEOP questionnaire and a MEOP poolee progress checklist were developed, and a standardized audition sheet was implemented for all formal auditions (MCRC, 2015a).

The action plan assigned the RS XO as the MEOP program manager nested under the HSCCP (MCRC, 2015a). It also tasked RS OSTs to request musician listings from each university to enable MCRC Advertising to “execute a targeted mass mail-out campaign to prospective applicants” (MCRC, 2015a, p. 4). These listings were to be shared with local enlisted recruiters to “enhance prospecting efforts for college level musicians” (MCRC, 2015a, p. 4).

The effects of the changes implemented by the 2015 OPT are examined in this study by analyzing trends in the years since its publication. The OPT did not conduct a year-by-year trend analysis of education codes at time of contract, nor did it test suspected or identified trends for statistical significance. The validity of data mining cleaning processes could not be verified based on this study’s analysis of the OPT’s presentation products.

B. BIG DATA CONCEPTS

An aspect of the recruiting operations mission set is to “collect, collate, analyze, display,” and distribute data in order to inform the decision-making process of recruiting leadership (MCRC, 2016, p. 6-2). Without an understanding of information management concepts and techniques, the amount of data created by recruiting operations risk being underutilized in decision-making processes.

The concepts found in Big Data (BD) literature are directly applicable to those operational tasks and needs. BD has been defined as being “based on large volumes of extensively varied data that are generated, captured, and processed at high velocity” (Günther, Mehrizi, Huysman, & Feldberg, 2017, p. 1). In 2014 Gandomi and Haider referred to these three qualities as the Three V’s of BD. Volume refers to the magnitude

of data, variety refers to the data's "structural heterogeneity," and "velocity refers to the rate at which data are generated and the speed at which it should be analyzed and acted upon" (Gandomi and Haider, 2014, p. 138). Gartner described the "Three V's" as "assets that demand cost-effective, innovative forms of information processing for enhanced insight and decision making" (Gartner, n.d., Glossary).

Variety in BD is often thought of in terms of often unstructured data that is incompatible with adjacent formats, is non-aligned, and has inconsistent semantic qualities that require special software, advanced indexing techniques, and distributed query management software to categorize and collate into useful analytic mediums (Laney, 2001). When the element of variety intersects with the element of volume, they may prove to be beyond the capabilities of the human mind to process. Big Data velocity refers to the "rate at which data are generated and the speed at which it should be analyzed and acted upon" (Gandomi & Haider, 2014, p. 138). The faster an organization is able to collect and observe data, the more agile and competitive it can become.

The concepts described in this section are best illustrated by the "Conceptual classification of BD challenges" as depicted in Figure 7, which visualize the "V's" of Big Data as well as the process and management challenges that must be addressed when managing large data sets (Sivaraja et al., 2017, p. 264). In its current form, MCRISS suffers from challenges across the entire data life cycle, as portrayed in Figure 7. However, in the year 2020 MCRC is poised to launch MCRISS 2.0 as a replacement of the current legacy system, which may address some of the negative aspects noted in the current system.

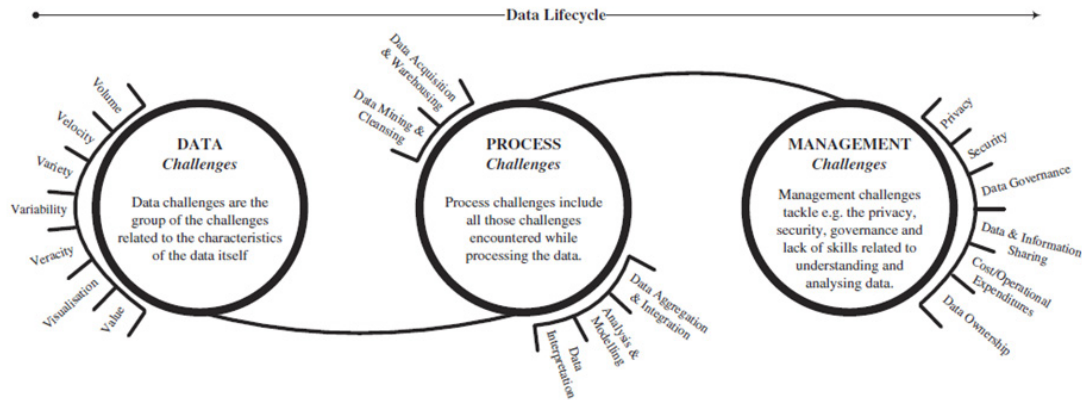


Figure 7. Conceptual classification of BD challenges. Source: Sivarajah et al. (2017, p. 264).

C. BIG DATA MANAGEMENT

The potential value of BD is only realized when it is leveraged to drive the decision-making process, and “to enable such evidence-based decision making, organizations need efficient processes to turn high volumes of fast-moving and diverse data into meaningful insights” (Gandomi & Haider, 2014, p. 140). In 2012, Labrinidis and Jagadish described five stages and two main sub-processes to extract insight. The first sub-process was data management, with three steps therein being: 1) acquisitions and recording; 2) extraction, cleaning, and annotation; and 3) integration, aggregation, and representation. The second sub-process was analytics and is composed of two steps defined as: 1) modeling and analysis; and 2) interpretation (Labrinidis & Jagadish, 2012).

The desired end state for historical analysis is to make a better-informed decision about the future, which requires methods for predictive analysis. This type of analysis is described as predicting future outcomes based on historical data and seeks to “uncover patterns and capture relationships in data” (Gandomi & Haider, 2014, p. 143). At a basic level it may involve the analysis of moving averages to discover historical patterns that can be extrapolated to future outcomes and may also include regression techniques in order to discover interdependencies between variables (Gandomi & Haider, 2014).

Three additional forms of data analysis include inquisitive analytics, prescriptive analytics, and pre-emptive analytics (Sivarajah, Kamal, Irani, & Weerakkody, 2016). Inquisitive analytics asks why something is happening and is “the study of data to validate/reject business hypotheses” (Bihani & Patil, 2014, p. 96). Prescriptive analytics answers questions of “so what” and “now what” in order to enhance future decisions (Sivarajah et al., 2017, p. 266). Pre-emptive analytics is “about having the capacity to take precautionary actions” to mitigate undesirable future outcomes (Sivarajah et al., 2017, p. 266). An encapsulation of these concepts is found in Figure 8.

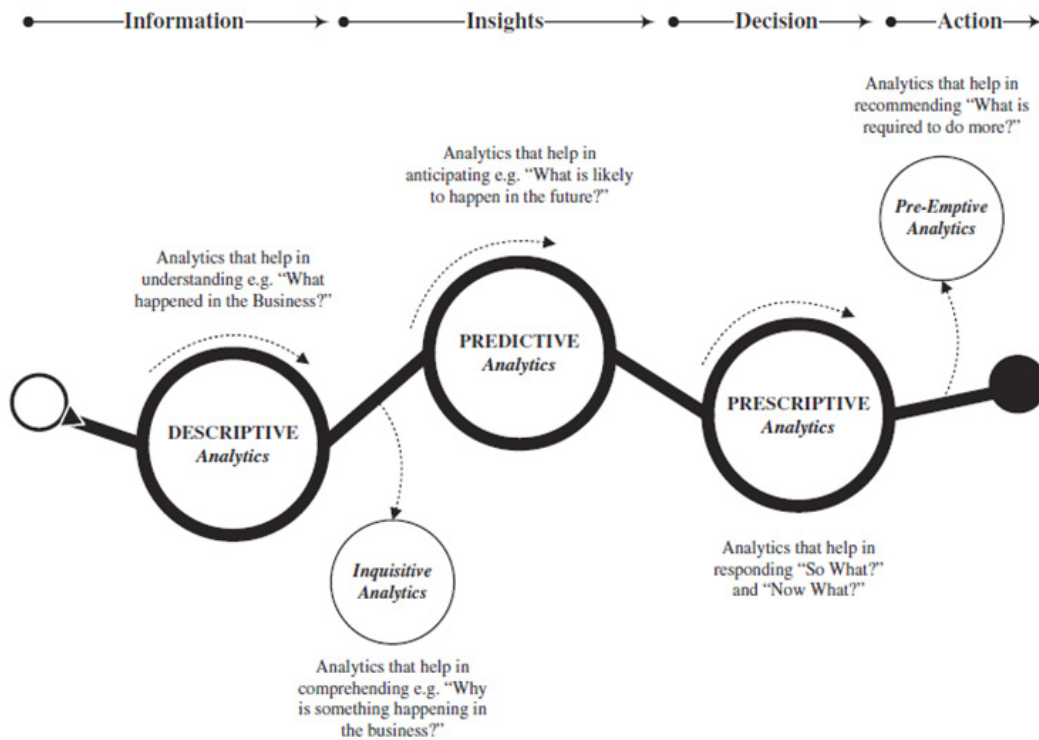


Figure 8. Classification types of Big Data analytical methods. Source: Sivarajah et al. (2017, p. 266).

D. CUSTOMER KNOWLEDGE MANAGEMENT

Customer Knowledge Management (CKM) seeks to gather information about customers and enable an organization to leverage insight from data in order to gain a

greater share of the target market (Nash, 2000). “The first step in generating insight is to transform customer data into a customer knowledge base” in order to create a holistic view of the target market (Nash, 2000, p. 3). The next step is to draw insight about “customer needs and expectations” (Nash, 2000, p. 4). Nash noted that this insight is descriptive in nature and can be used to “anticipate customer behavior to shape interactions accordingly, and measure performance in terms of customer value...” (Nash, 2000, p. 4). Several uses of customer insight are “driving market planning through strategic segmentation, media planning, and effectiveness...” in determining what offers to present the target audience in order to influence their behavior (Nash, 2000, p. 4).

In 2002, Garcia-Murillo and Annabi built on Nash’s concepts by developing a “components of firm knowledge” framework that defined an organization’s knowledge about its market (Garcia-Murillo & Annabi, 2002, p. 876). Garcia-Murillo and Annabi’s CKM process was similar to Nash’s, but was stated in terms of knowledge revealing, sorting, and leveling (Garcia-Murillo & Annabi, 2002). Components of their holistic framework included suppliers, products, customers, industry, employees, operations, and competitors. Each of these components can be related to how the Marine Corps can identify market trends in order to make better-informed business process decisions about recruiting and retention for MEOP Marines.

E. DATA MINING PROCESS MODELS

The data mining model that served as a primary reference for this study was the Cross-Industry Standard Process for Data Mining (CRISP-DM) model, which is a “hierarchical process model, consisting of sets of tasks described at four levels of abstraction (from general to specific): phase, generic task, specialized task, and process instance” (Chapman, Clinton, Kerber, Khabaza, Reinarts, Shearer, & Wirth, 2000, p. 6). This has been used in previous Big Data research efforts, such as Deschler’s 2019 use of Big Data analytics to improve MV-22 Osprey aircraft maintenance processes. A visualized conception of CRISP-DM processes appear in Figure 9 and Figure 10.

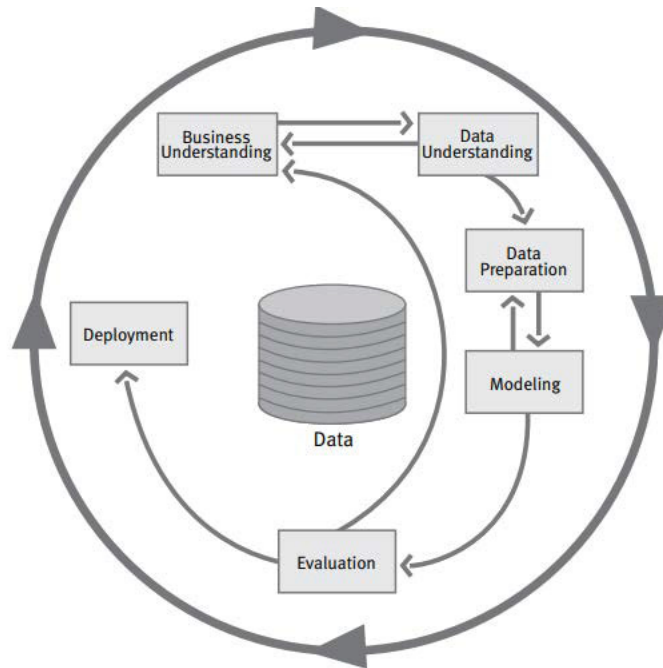


Figure 9. Phases of the CRISP-DM reference model. Source: Chapman et al. (2000, p. 10).

Business Understanding	Data Understanding	Data Preparation	Modeling	Evaluation	Deployment
Determine Business Objectives <i>Background</i> <i>Business Objectives</i> <i>Business Success Criteria</i>	Collect Initial Data <i>Initial Data Collection Report</i>	Select Data <i>Rationale for Inclusion/Exclusion</i>	Select Modeling Techniques <i>Modeling Technique</i> <i>Modeling Assumptions</i>	Evaluate Results <i>Assessment of Data Mining Results w.r.t. Business Success Criteria</i> <i>Approved Models</i>	Plan Deployment <i>Deployment Plan</i>
Assess Situation <i>Inventory of Resources</i> <i>Requirements, Assumptions, and Constraints</i> <i>Risks and Contingencies</i> <i>Terminology</i> <i>Costs and Benefits</i>	Describe Data <i>Data Description Report</i>	Clean Data <i>Data Cleaning Report</i>	Generate Test Design <i>Test Design</i>	Review Process <i>Review of Process</i>	Plan Monitoring and Maintenance <i>Monitoring and Maintenance Plan</i>
Determine Data Mining Goals <i>Data Mining Goals</i> <i>Data Mining Success Criteria</i>	Explore Data <i>Data Exploration Report</i>	Construct Data <i>Derived Attributes</i> <i>Generated Records</i>	Build Model <i>Parameter Settings</i> <i>Models</i> <i>Model Descriptions</i>	Determine Next Steps <i>List of Possible Actions</i> <i>Decision</i>	Produce Final Report <i>Final Report</i> <i>Final Presentation</i>
Produce Project Plan <i>Project Plan</i> <i>Initial Assessment of Tools and Techniques</i>	Verify Data Quality <i>Data Quality Report</i>	Integrate Data <i>Merged Data</i>	Assess Model <i>Model Assessment</i> <i>Revised Parameter Settings</i>		Review Project <i>Experience</i> <i>Documentation</i>
		Format Data <i>Reformatted Data</i>			
		<i>Dataset</i> <i>Dataset Description</i>			

Figure 10. Generic task (bold) and outputs (italics) of the CRISP-DM reference model. Source: Chapman et al. (2000, p. 12).

F. NATIONAL MARKET TRENDS FOR EDUCATION AND MUSICIANS

If the Marine Corps intends to seek musicians whose talents and backgrounds meet the needs of the Marine Corps Music Program, it is necessary to first understand the existing environment for high schools, universities, and the professional marketplace. This section seeks to explore educational and professional trends in high schools, universities, and the national workforce for musicians.

1. National Secondary Education Trends

In 2019, Elpus and Abril constructed a demographic profile of high school ensemble students for the high school class of 2013. With restricted-use data from the National Center for Education Statistics (NCES) that included high school transcript data, they examined bivariate relationships between demographic characteristics and also used logistic regression techniques to estimate the likelihood of at least one year of musical ensemble participation (Elpus & Abril, 2019). Their study found that for the graduating class of 2013, 11% of students had taken at least one credit in a band course while 2% received credit for an orchestra course. They found that 52% of those with band experience and 39% of those with orchestra experience were male. 62% of students with band experience were white, 11% were black or African American, and 16% were Hispanic or Latino. The top two quintiles of socioeconomic status were over-represented at 31% and 22%, respectively (Elpus & Abril, 2019). While the 2019 Elpus & Abril study found that males outnumbered females for the class of 2013, a 2015 study found that females outnumbered males in nine of ten data sets from 1982 to 2009 (Elplus, 2015). Elpus and Abril also hinted at a correlation between standardized math test scores and participation in band or orchestra (Eplus & Abril, 2019). While the overall population highest math test quintile for standardized math test scores was 20%, it was 31% for band participation and 43% for orchestra participation (Elpus & Abril, 2019).

In 2012, Parsad and Spiegelman compiled a report for NCES on the status of arts education in public elementary and secondary schools from 1999–2000 and 2009–2010. As discussed by Elpus and Abril, Parsad and Spiegelman found that in school year 2009–2010, 76% of public secondary schools reported providing activities for choir, band, or

marching band activities outside of school hours. They also suggested at the time of their report that 91% of secondary public schools made some form of music education available, although “that the availability of music was linked to the socioeconomic statuses of the families” (Elpus & Abril, 2019, p. 8).

2. National Postsecondary Education Trends

Of the 2.9 million recent high school graduates in 2017, 67% enrolled in a college by the following October (National Center for Education Statistics [NCES], 2019). This observation was “not measurably different from the rate in 2000 or 2010” (NCES, 2019, p. 146). The overall college enrollment rate was defined as the “percentage of 18–24-year-olds... enrolled as undergraduate or graduate students at two or four-year institutions” (NCES, 2019, p. 150). This enrollment rate increased from 35% in the year 2000 to 40% in 2017. The NCES report stated that “for first-time, full-time degree-seeking undergraduate students who enrolled in 4-year degree-granting institutions in fall 2016, the retention rate was 81 percent” (NCES, 2019, p. 196). This figure ranged from 96% at extremely selective institutions to 54% at private for-profit four-year institutions (NCES, 2019). Additionally, “by 2017 some 60 percent of students had completed a bachelor’s degree at the same institution where they started in 2011” (NCES, 2019, p. 198). The highest rates of graduation was 66% at private nonprofit institutions, followed by 60% for public institutions, and a paltry 21% at private for-profit schools (NCES, 2019). Finally, graduation rates “varied according to institutional selectivity,” with the most selective schools (defined by NCES as having acceptance rates less than 25%) having the highest graduation rates, and the least selective (defined by NCES as having an “open admissions policy” having the lowest graduation rates (NCES, 2019, p. 198).

In SY16-17 “the average net price of attendance (total cost minus grants and scholarship aid)” for “first-time, full-time undergraduate students” was \$24,300 for those living on campus, \$24,200 living off campus, and \$14,400 for those living with family (NCES, 2019, p. 206–209). In years 2015–2016, those who received their bachelor’s degree and took out student loans had an “average cumulative loan amount borrowed” amount of \$28,000 for public institutions, \$33,200 for private nonprofit, and \$43,000 for

private for-profit (NCES, 2019, p. 218). For those only completing an associates degree, debt amounts were \$16,300, \$25,900, and \$27,500, respectively (NCES, 2019). In years 2016–2017, approximately 46% of “first-time, full-time degree/certificate-seeking undergraduate students were awarded loan aid” while between years 2010–2011 and 2016–2017 “the average annual undergraduate student loan amount decreased 3 percent, from \$7,400 to \$7,200” (NCES, 2019, p. 214). The dollar figures discussed in this paragraph have been adjusted to reflect constant 2017–2018 dollar values (NCES, 2019).

In 2015, the College Music Society researched music and higher education in the United States and found that there were 1,795 institutions having degree-granting programs in music. They found that in fall 2010 there were approximately 332,297 persons enrolled in college music programs (College Music Society, 2015). In 2019 the Higher Education Arts Data Service (HEADS) studied music data for SY18-19 that was compiled data from annual reports provided by the National Association of Schools of Music. They found that there were 29 public or private institutions granting Associate of Fine Arts degrees, with these schools having a total enrollment of 1,283 students (Higher Education Arts Data Service [HEADS], 2019).). HEADS considered a “fine arts degree program or an equivalent” to have at least 65% music content in its curriculum (HEADS, 2019, p. 17).

3. National Employment for the Musical Arts

The Bureau of Labor Statistics (BLS) tracks national statistics for pay, job outlook, and geographic concentration of jobs in entire job fields. Meanwhile, the Higher Education Arts Data Services (HEADS) tracks salaries of educators at public and private universities. In 2018, the median pay for musicians and singers was \$58,552/year for musicians working 40 hours/week. for 52 weeks (Bureau of Labor Statistic [BLS], n.d.-a) The BLS median wage estimation is similar to the 50th percentile wage for the full-time musician assistant professors at private institutions (\$58,201) and public institutions (\$57,521), as described by HEADS in 2019. The HEADS study for musician median incomes is similar to the reported median household income from 2013–2017, which was \$57,652 (United States Census Bureau, n.d., QuickFacts). The average annual salary for

part-time musician faculty members for all reporting public and private institutions was \$23,691, and was \$12,061 for adjunct faculty (HEADS, 2019). The 2018 median pay for all high school teachers was \$60,320/year, \$58,600/year for middle schools, and \$57,980/year for elementary schools (BLS, n.d.-a). These median figures did not describe entry-level salaries, account for regional differentiations, or specific teaching topics. The median national starting salary for teachers was \$38,140 (National Education Association, n.d.)

In 2019, a study conducted by Garcia, A. attempted to determine the most and least valuable college majors by examining data from the U.S. Census Bureau American Community Survey to analyze incomes, education levels, and unemployment rates of people based on their undergraduate degree. The study used a weighted ranking scale of median incomes, unemployment rates, and percentages of those with a college degree. Of the 162 academic majors listed in a table titled “Most to least valuable college majors,” “music” ranked 155th, “fine arts” was 158th, and “visual and performing arts” was 161st (Garcia, 2019, Ranking table). The median annual income for music majors was reported to be \$35,000, with 42% having an advanced degree and an overall unemployment rate of 3.1% (Garcia, 2019). Garcia’s research analyzed Census Bureau data on self-reported college major and income over the previous twelve months regardless of an individual’s current sector of employment. This may indicate that expected median income as a musician is equitable to the overall median household income, that obtaining a job in that sector may be relatively competitive, or that those musician jobs’ starting wages are comparatively low.

G. MILITARY DEMOGRAPHICS AND ENLISTMENT INCENTIVES

1. Trends in Military Demographics

A 2017 demographics report found that the Marine Corps represented 14.2% of the active duty population (Office of the Deputy Assistant Secretary of Defense for Community and Family Policy [ODASD MC&FP], 2017). Compared to Von Ah’s 2017 GAO report that detailed the size of each active duty band, it appears that the Marine Corps has the largest proportion of musicians compared to the size of its overall

population. However, Von Ah noted that the Marine Corps is the only service to use its field band members in combat environments for tasks other than musical performance (Von Ah, 2017). Their analysis found that Marine Corps has the smallest proportion of active duty females of any service (ODASD MC&FP, 2017). The Marine Corps also has the highest proportion of enlisted active duty members whose highest level of education is a high school diploma, as shown in Table 2.

Table 2. Percentage of active duty enlisted members by education level in 2017. Adapted from ODASD MC&FP, (2017).

Degree Attained	Active Duty Enlisted Force			
	Marine Corps	Army	Navy	Air Force
No High School Diploma or GED	0.03%	0.24%	0.38%	0.01%
High School Diploma or Some College	94.20%	84.14%	83.31%	64.01%
Associate degree	2.28%	6.36%	7.70%	24.59%
Bachelor's Degree	2.61%	7.80%	7.35%	8.67%
Advanced Degree	0.31%	1.27%	0.89%	1.81%
Unknown	0.56%	0.20%	0.37%	0.90%

Note: These figures were calculated by converting the original source's reporting of gross numbers in the table "Number of Active Duty Enlisted Members and Officers by Service Branch and Education Level" into percentages.

2. Trends in Military Compensation Compared to the Civilian Market

A 2019 report by Hosek, Asch, Mattock, and Smith analyzed trends between education levels, regular military compensation (RMC), and civilian pay. They defined RMC as the sum of basic pay, basic allowance for housing and sustenance, and federal tax advantages. They found that the regular military compensation (RMC) for a service member with four years of service having only a high school degree related to the 98th percentile of compensation for comparatively educated civilians. For those with some college it dropped to 91, an associate degree was 84, a bachelor's degree 64, and a master's degree 47 (Hosek et al., 2018). This appears to show that military compensation

is competitive for individuals with only a high school degree, and that the military's competitive advantage decreases with each degree obtained (Hosek et al., 2018).

The DOD publishes annual military composite standard pay and reimbursement rates, which are useful for the purpose of conducting an analysis of what a prospective MEOP applicant can expect to earn versus the civilian-sector jobs. The Average Basic Pays shown in Table 3 appear to indicate a competitive disadvantage to the wages discussed for civilian musician professions, while the annual DOD composite rate is equitable to the median pay for private sector musician professions (Office of the Under Secretary of Defense [OUSD], 2018). The DOD composite rate accounts for a Medicare expenses, basic allowance for housing (BAH), basic allowance for sustenance, incentive pays, and change of duty station expenses. While the composite rates appear to be competitive to the private market *prima facie*, not all service members qualify for BAH or incentive pay (there is not a monthly incentive pay for musicians that the research team is aware of), and many civilian jobs come with fringe benefits that may not be factored into median pay figures.

Table 3. FY19 military composite standard pay and reimbursement Rates for the Marine Corps. Adapted from OUSD, 2018.

Pay Grade	Average Basic Pay	DOD Composite Rate
E-5	\$34,565	\$78,781
E-4	\$28,746	\$64,267
E-3	\$24,416	\$55,040
E-2	\$22,467	\$49,697
E-1	\$19,058	\$44,588

3. Additional Financial Enlistment Incentives

Understanding the current incentive strategies being used by the military to attract certain target markets is important in understanding any trends in those who ultimately enlist. The Marine Corps' incentives for enticing qualified musicians to enlist are nested in enlistment bonuses, other tangible incentives that are ubiquitous amongst all branches,

and the intangible benefits of being a Marine marketed by MCRC recruiting strategies (Manpower & Reserve Affairs [M&RA], 2019) (MCRC, 2014a).

A 1986 study investigated the Army's efforts to increase the quantity and quality of recruits by offering an enlistment bonus to individuals with "above-average aptitude who enlist in special skill categories for four-year terms" (Polich, M., Dertouzos, J. & Press, S., 1986, p. 1). The focus of the study was on whether such a program would attract more high-quality high school graduates who could perform difficult to fill specialty jobs (Polich et al., 1986). The results of their study found that bonus programs had "striking effects on the number of high-quality enlistees attracted to priority skills and on the number of the latter signing up for the longer terms [of enlistment]" (Polich, M. et al., 1986, p. 1).

In 1998, a study investigated methods to attract high-quality recruits in an environment dominated by low national unemployment rates, demographic changes, and rising college attendance rates (Asch, Kilburn, & Klerman, 1999). The study suggested that the military would encounter increasing difficulties in enlisted recruiting because of competition with civilian employers and post-secondary educational institutions, and sought to discover incentives that would increase the propensity to enlist for college-bound youths (Asch et al., 1999). The study noted a rise in those pursuing an undergraduate degree after high school and a rise in the amount of debt students incurred in pursuit of undergraduate degrees (Asch et al., 1999). Their study recommended that the services investigate specific incentives to attract these educated and indebted individuals, but did not provide any detailed suggestions (Asch et al., 1999).

In 2008, Ramsey, B. conducted an analysis of the effectiveness of the Marine Corps' Enlisted Bonus Program (EBP). The study stated that "enlistment bonuses are used to attract highly qualified applicants into critically short enlistment programs" but lacked an ability to determine an optimal enlistment bonus dollar amount for particular job programs (Ramsey, B. 2008, p. v). Ramsey found that the monetary incentives offered in the EBP had remained generally unchanged for several years, and speculated that historically static bonus amounts may lead to a decrease in effectiveness. Ramsey

concluded that the Marine Corps could more effectively target EBP money by conducting a choice-based study on program incentives (Ramsey, B. 2008).

H. METHODS TO CONDUCT TREND ANALYSES

This section discusses references that informed the authors on the variety of techniques available for data gathering and data analysis that are applied in Chapter III and Chapter IV of this study, and how other studies have applied similar methods.

1. Descriptive Statistics

A goal of this research is to describe the demographic characteristics of the target population in order to enable the discovery of more effective recruiting practices. In 2018, Keller described several techniques for descriptive statistics that are applied throughout the methods and analysis section of this research. The task of performing numeric descriptive techniques, data collection, sampling, hypothesis testing, inferences comparing populations, and other statistical analyses were informed by the methods described by Keller's 2018 work. In data analytics, describing "what happened" is the foundation of being able to answer the follow-on questions of "why did this happen," "what is likely to happen in the future," and "what should we do next" (Sivarajah et al., 2017, p. 266).

2. Decision Modeling Techniques

In 2013, Balakrishnan, Render, and Stair discussed how to conduct data analyses and effectively display results using Microsoft Excel software. Their work helped inform the authors of this study on how to move from the realm of conceptual to applicative by using software that is available on every MCRC computer, thus making this study's methods repeatable for future research within MCRC. An illustrated representation of the several branches of forecasting models are shown in Figure 11.

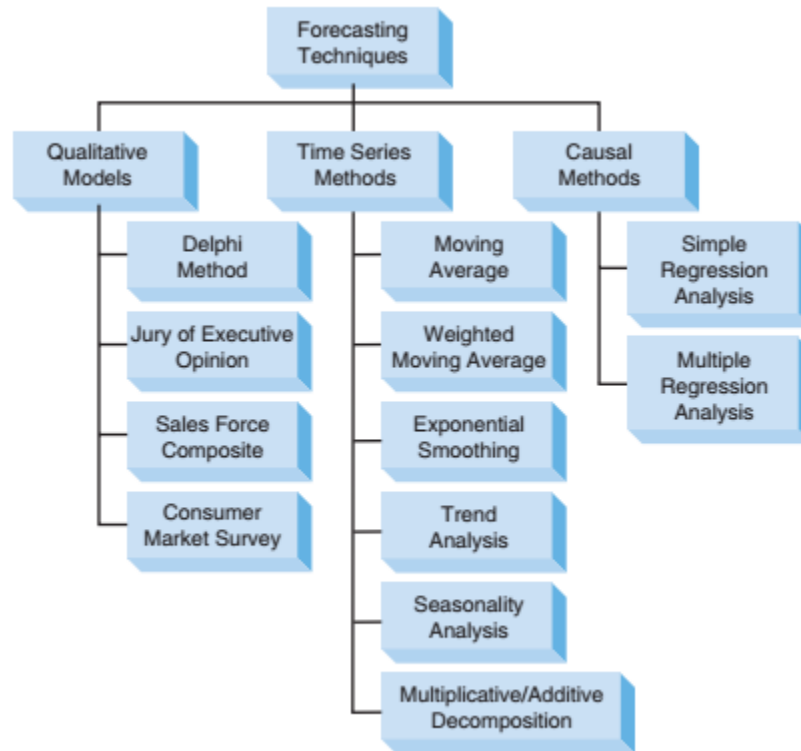


Figure 11. Forecasting models discussed. Source: Balakrishnan et al. (2013, p. 447).

3. Previous Descriptive and Statistical Analyses Applied to USMC Recruiting

A common type of analyses found in the review of other recruiting related research was linear regression. In 2005, Bruno created binary probit models to analyze four years of recruiting data, and then built on this information by developing linear regression models to investigate predictive analysis of a recruit's propensity to attrite from the Delayed Entry Program (DEP). In 2007, Baykiz conducted a similar analysis by developing regression models to investigate any relationships between education level at time of contract and DEP attrition. Those models found that high school seniors were more likely to attrite from the DEP than high school graduates, as were females, poolees without dependents, those with lower AFQT scores, end of a month contracts, and those who spent the longest time in the DEP (Baykiz, 2007).

In 2006, Baczkowski used regression models to analyze the effects of end-of-month recruiting on USMC recruit training depot attrition. While Baykiz's research found attrition from the DEP to be higher for end-of-month contracts, Baczkowski's models indicated that there was no evidence to indicate that end-of-month recruits suffer from higher attrition at recruit training (Baczkowski, 2006). In 2008, Jeppe developed multivariate probit models to discover relationships that may exist between moral waivers and unsuitable attrition from the Marine Corps and investigated whether or not certain demographic characteristics exacerbated the effect of moral waivers on attrition outcomes. In 2018, Sanchez conducted a multivariate analysis of how recruiter productivity varied with market saturation and the relationship between productivity and quality and concluded that MCRC would benefit from an increase in production recruiters and improved metrics to select Marines for recruiting duty.

I. SUMMARY

The goal of the authors in this chapter was to conduct a review of previous research conducted for the MEOP and the factors that impact the Marine Corps' ability to effectively recruit these individuals. To help understand the methodology of managing and interpreting data, this chapter discussed theories of data collection, data management, and customer knowledge management. These theoretical concepts and frameworks can then be applied by formal methodologies of descriptive analytics and statistical modeling techniques. The topics discussed in this chapter form the foundation of developing the methods of collection, modeling, and analysis that are discussed in Chapter III.

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III. DATA PREPARATION METHODOLOGY

A. DATA MINING OVERVIEW

This chapter explains the methodology used to collect, clean, collate, and analyze the dataset obtained for this research. The methodology used is rooted in the Big Data collection and analysis theory explained in Chapter II. The structure, methods, and techniques used to conduct statistical analysis of this study's dataset is built on the foundation laid by analogous MCRC-related research conducted by Sanchez in 2018, Ramsey, B. in 2008, Jeppe in 2008, Baykiz in 2007, Baczkowski in 2006, and Bruno in 2005. All of these studies utilized historical data from MCRISS and applied various methodologies to analyze their datasets.

B. DATA MINING PROCESS

The reference used in this study for data acquisition, processing, and management is from the "Conceptual Classification of BD Challenges" model depicted in Figure 7 (Sivarajah et al., 2017, p. 265). The processing portion of Sivarajah's conceptualization that are applicable to obtaining the dataset used for this study are: data acquisition, mining, cleaning, and aggregation/integration (Sivarajah et al., 2017). The CRISP-DM data mining guide discussed in Chapter II was also used as a primary reference in this study's mining and cleaning efforts (Chapman et. al., 2000).

1. Dataset Acquisition

The dataset utilized for this research was mined from the MCRISS database using a laptop loaned by MCRC to the student author from August, 2019 through January, 2020. A virtual private network was established on a local wireless network in order to gain access to the MCRISS RDBMS on the Marine Corps Recruiting Enterprise Network (MCREN). The student author had three years of previous experience using the MCRISS system for the purpose of data mining and analysis.

a. MCRISS Query Tool

The MCRISS Query Tool is a front-end platform to query the MCRISS RDBMS. This database is not static in a historical sense, and is subject to updates as applicants progress through the enlistment process. Certain entries are restricted from editing by users without special permissions at certain points along this process to prevent corruption or alteration of data that is intended to serve as a historical record. The MCRISS Query Tool has five main elements: Content, Filters, Layout, and Output/Schedule. The Content tab allows users to select from a list of dozens of demographic variables for each applicant entered into the MCRISS database by their recruiter. The Filters tab is loosely based on the type of query one would build based on SQL-style language, but is structured in a manner to allow a user to build a query using drop down menus without prior experience with SQL query structure. An example of the query interface used for this study appears in Figure 12. By using this filtering method, this study’s primary dataset resulted in 1,899 entries representing the population of all MEOP applicants with a PEF of “U2XX” that shipped to recruit training from FY05 and FY19.

The screenshot shows the 'Filters' tab of the MCRISS Query Tool. At the top, there are tabs for 'Content', 'Filters', 'Formats', 'Layout', and 'Output/Schedules'. Below these, the 'Name' field is set to 'NPS MEOP Query' and the 'Description' field is set to 'MCRC MEOP'. The main area contains a table with columns: Prompt, Selected, Legend, Join, Field, Operator, and Value. Two filters are applied:

Prompt	Selected	Legend	Join	Field	Operator	Value
DEP Date	☒	☒	And	DEP Date	Between	20041001 and 20190930
Program - PEF	☒	☒	And	Program - PEF	Starts With	U2

Figure 12. MCRISS Query Tool filters tab. Source: MCRC (2019).

b. MCRISS Automated Reports

The “Automated Reports” section of MCRISS generates a litany of reports for the purpose of data analysis by recruiting personnel. Of interest to this research were the High School Progress Reports. Amongst other things, this report shows how many working schools each Recruiting District has within its area of operations, and how many band talks were planned and completed. The weakness of this report is that it is generated for each individual school year (SY), and the largest echelon available for query is for

each of the six individual Marine Corps Districts. Multi-year or multi-district queries were not possible. In order to obtain 15 SYs worth of MCRC-wide reports, it meant that 90 individual reports had to be generated, downloaded, and then aggregated into a useful format. This research's specific area of focus from these reports were the "Total Working High Schools," "High School Band Talks Planned," "High School Band Talks Completed," and "Percent of High School Band Talks Completed." These variables were manually extracted and compiled into an Excel file that allowed trend analysis over 15 SYs. These reports are referenced as "MCRC, 2019a" in the works cited.

2. Dataset Cleaning and Formatting

Before transferring the primary data set from the MCREN, the query's primary key of "Social Security Number" (SSN) was used to identify duplicate entries. There were no duplicate entries identified. However, there was one SSN that had two unique entries. This individual had previously shipped to recruit training, but attrited before graduation. The individual had been discharged for an involuntary and non-disabling medical condition that allowed re-enlistment and re-shipping on a later date. Any column that had a calendar date entry was transformed into a standardized format using the text-to-columns feature of Excel. This was done due to the variety of formats that were entered in the years spanning the dataset's parameters, many with time stamp entries that were not useful. Other minor cleansing and standardizations methods are described individually in this study's explanation of variables, along with the methodology used to define how derivative variables were calculated and formatted.

3. Dataset Limitations

The historical data queried from the MCRISS database is often limited in its utility for research because of its questionable veracity (Bruno, 2005). Bruno stated, "in a discussion with [MCRC], the author was informed that the MCRISS system was never intended for data analysis" (Bruno, 2005, p. 116). To that end, it should be recognized that MCRISS has been described by the Marine Corps as the "authoritative data source for accession data" and that "through the collection of data, it enables demographic and market analysis to optimize the performance of the recruiting force" (CANDP, n.d.,

MCRISS). Recruiting is inherently a human-oriented business, and ultimately it is humans entering and updating the data contained in the MCRISS database. Data veracity relies on the accuracy of recruiting personnel inputs and the ability of leadership to enforce data entry standards over time. Until the human element is removed from recruiting, human error will not be removed from MCRISS.

Information that was sought but not obtained for this study include historical data of first-time audition passage rates and the number of official auditions conducted for MEOP applicants. This study's point of contact at MCRC stated that while there are efforts to track these categories, the veracity of this information is unreliable because of a lack of adherence to systematic recruiting practices at the RS level as it pertains to reported auditions. This study also did not integrated data from the Marine Corps Total Force Data Warehouse (TFDW). Although access was granted by MCRC to access the TFDW, it was not deemed necessary to answer the primary research questions.

4. Dataset Incongruities

a. Education Code at Contract

When beginning the initial analysis of the ECC distribution, the researchers noticed what appeared to be set of outliers in FY18 and FY19 for those classified as "high school seniors" (HSS), education code "11." While the data seemed to indicate that the proportion of HSS had been trending down over the 15 years, this proportion decreased precipitously in FY18 and FY19. For instance, in FY17 the education code "11" represented 26.9% of the MEOP population for that year, but in FY18 it dropped to 7.5%, and then 4.2% in FY19. This drastic decrease prompted the research team to also analyze this demographic by age, and they found that an abnormally high majority of "12" (high school graduate) education codes were also 17-years-old at time of contract.

Given the unlikelihood of such a large number of 17-year-old's being high school graduates at time of contracting during these two years, and the disparity in proportions from previous years, it was concluded that the veracity of the "Education Code at Contract" (ECC) variable for the "11" education code in FY18 and FY19 was highly questionable, and would negatively skew the analysis if included. It is also worth noting

that when the “11” and “12” education codes are grouped for those two years, their combined proportions generally align with trends from the previous 13 years. This indicated that there may have been a widespread data entry problem during these two years, or there may be a data systems issue causing an invalid overwrite in the RDBMS. The student author hypothesized that the introduction of the Recruiter Client Tool (RCT) in August 2017 may be a causal factor, as that application was known to have syncing issues with the MCRISS upon its implementation in MCRC. As of the year 2020, RCT is no longer being used by MCRC as it transitions to the MCRISS 2.0 platform.

The student author attempted to reconcile this issue with the points of contact in MCRC G-3 offices, and their response generally aligned with the research team’s assumptions, which were that the issue is either due to user error or a system processing error. An analysis of the entire MCRC recruited population may reveal a similar trend in seemingly erroneous ECC entries for FY18-19. Given these issues, this study’s hypotheses primarily focus is on “Education Code at Shipping” (ECS) for its statistical analyses. This variable has a higher level of veracity given that it is validated at the Military Entrance Processing Station (MEPS) before shipping to recruit training with copies of diplomas and transcripts. The exception to our use of ECS vice ECC are analysis of education codes “11” and “12” for the ECC variable for years FY05-FY17.

b. Disparities between “Education Code at Shipping” and “Education Code at Contract”

To analyze any abnormalities between education codes at contracting and at shipping, pivot table was created that categorized the numerical delta between the two values, as seen in Table 4. The research team expected that many instances would show a delta of one, indicating completion of the grade they were in when contracted. For example, the expectation was that most “11” codes would become “12” before shipping, demonstrating the completion of the 12th grade. Bear in mind that the numeric code is an indicator of the highest grade *completed*, not the current grade of the individual.

Table 4. Numeric delta between Education Code at Contract and Education Code at Shipping

Education Code	Count of Education Code at Contracting and Shipping Delta											Total
	-4	-3	-2	-1	0	1	2	3	4	5	7	
7					1							1
10					1							1
11					17	711	4	2	2	3	1	740
12					713	16	11	13	31	2		786
13				3	32							35
14			1	1	32		2					36
15		2			45	15		2				64
16	3				203	2						208
17				1	25							26
18					1							1
19					1							1
Total	3	2	1	5	1071	744	17	17	33	5	1	1899

Note: Data derived from Marine Corps Recruiting Command (2019, December 31).

This study's analysis showed that 9.29% of the population that reported as a "12" at time of contract had at least one more year of additional education confirmed by their ship date. The same "12" population showed that 7.25% reported two or more years of additional education at time of contract, which may indicate that some were actually at least a college freshman at time of contract. The disparity may be explained by a lack of education credentials at time of contract that were later produced before shipping. These 57 individuals and represented 3.0% of the total population of this study's dataset. This led the research team to believe that the instances of "12" at time of contract may have been inflated, and those who are were actually codes 13–19 may have been underreported. The entire population of the dataset was comprised of 371 individuals who reported codes between 13–19 at time of contract. An additional 57 would represent an underreporting of college educated individuals at contracting by 15%. Other deltas of a less significant quantity may be explained by failure to produce the required education credential by their ship date or inaccurate initial reporting of education level.

Due to these disparities, the variable Education Code at Shipping (ECS) was chosen in lieu of Education Code at Contracting (ECC) for most of the analyses. It is the opinion of the research team that this represents a more accurate picture of the overall education demographics of the MEOP market. The exception to this is this study's analysis of potential market shifts between codes "11" and "12," for which the ECC variable is used. This is because that 96.0% of codes recorded as "11" at time of contract reported as "12" at shipping, indicating graduating from high school before shipping to recruit training. Using "Education Code at Contract" for the "11" variable in years FY05-17 allowed the research team to analyze shifts in the proportion of those contracted as high school seniors over time.

5. Analysis Software

Microsoft Excel version 16.37 with the Data Analysis, Solver, and Power Map add-ins was used to clean, aggregate, integrate, analyze, model, and interpret the MCRISS dataset for this study (Sivarajah et al., 2017). The relatively small size of the data set and the ubiquity of Excel software on MCRC assets made it ideal for this study's purposes, and enables MCRC personnel to validate or replicate this study's methods without the need for additional software.

C. EXPLANATION OF VARIABLES

1. Selected MCRISS Dataset Variables

The following variables were selected from the drop-in list in the MCRISS Query Tool interface. They were chosen based on their utility for answering the primary research questions of this study. Not all of the select variables were used for later analysis, but provided a level of utility in preparing the data. A brief description of each variable has been provided, similar to the method used by Sanchez in 2018.

a. Social Security Number

The Social Security Number (SSN) serves as the primary key for each applicant in the MCRISS RDBMS. While querying the SSN was necessary to retrieve the dataset,

it was replaced with a unique identifier (UID) before transferring the dataset from the MCREN to the NPS network.

b. Ship Date

This is the date that the poolee was sent to a Marine Corp Recruit Depot (MCRD) to attend recruit training. A RS gets credit toward its annual MEOP mission only after the MEOP poolee has shipped. MCRC's fiscal year recruiting mission is based on a shipping quota. Shipping their assigned annual shipping mission is the *raison d'être* of every RS in MCRC.

c. DEP Date

This is the Delayed Entry Program entry date. This date may serve one of two meanings. It may be the date an individual enlisted into the Marine Corps Delayed Entry Program at a Military Entrance Processing Station (MEPS) and was credited as a contract in MCRISS for the purpose of contracting mission credit. However, recent years MCRC introduced the "DEP and Hold" program where an individual enlists at MEPS, but the RS may delay "force contracting" them toward the monthly contracting mission for up to 60 days (MCRC, 2016, p. 7-14). In this instance, the date of the "force contract" is shown as the "DEP Date," although this does not represent the date of actual enlistment. To differentiate these two dates, MCRISS also has a "MEPS Contract Date" entry, which is the *bona fide* date of initial enlistment for statutory purposes. This study's dataset covered a period that predated the DEP and Hold program, when the DEP Date and MEPS Contract Date would have been identical. To account for this, a derivative variable that applied a correction factor so that all calculations were based on the effective actual date of enlistment at MEPS was created, whether or not a MEPS Contract Date existed in the individual's record.

d. MEPS Contract Date

This is the date that an applicant signs their initial enlistment contract and swears an oath of enlistment at MEPS and either enters the Delayed Entry Program, or is shipped directly to recruit training. A poolee may spend up to 365 in the DEP under normal

circumstances, or 410 days if they enlist during the spring of their junior year of high school. Extensions beyond these limitations are possible for extenuating circumstances. These dates are measured from the MEPS Contract Date. Because the DEP and Hold program was not in effect for the entirety the time spanning this study's dataset, only 722 out of 1,899 individuals had a MEPS Contract Date recorded in their entry row.

e. ASVAB AFQT Score

This is the score an applicant received on their Armed Services Vocational Aptitude Battery (ASVAB). "AFQT" is the Armed Forces Qualification Test, and scoring ranges from 1–99. The minimum USMC standard is 31. The minimum standard without a waiver for a U2 PEF is 50.

f. ASVAB Mental Group

AFQT scores pertinent to USMC applicants are broken down into five mental group categories. The Category I AFQT range is 93–99, Category II is 65–92, Category IIIA is 50–64, Category IIIB is 31–49, and Category IV is 21–30 (MCRC, 2014, p. 7-115). MCRC currently requires 63% of all accessions to be Category I, II, or IIIA (referred to as "Alphas"). The remaining 37% may be Category IIIB (referred to as "Bravos"). Category IV accessions are generally not authorized. MEOP accessions must be "Alphas" unless an AFQT waiver is approved (MCRC, 2016, p. 3-10).

g. Date of Birth

The date the individual was born, as verified by their birth certificate.

h. Education Code at Contract

The education code of the individual at the time of their initial enlistment. The 2014 Enlisted Processing Manual gives specificity what education code is to be assigned based on the individual's educational circumstances and are generally categorized as shown in Table 5.

Table 5. Education code meaning. Adapted from MCRC (2014).

Numerical Identifier	Meaning
1 through 10	Completed Grade 1, 2, 3... 10, alternative credential holder.
11	Completed 11 th Grade, High School Senior
12	Completed 12 th Grade, High School graduate or equivalent alternative credential
13 through 16	Completed 1, 2, 3, or 4 years of college
17	Master's degree/certificate
18	Post-master's certificate
19	Doctorate

i. Education Tier

MCRC uses a three-tiered system to categorize the education status of those who enlist. MCRC requires that 95% of all accessions be categorized as Tier I. Tier III is not authorized. The Marine Corps Enlisted Processing Manual generally categorizes the education tiers as follows:

- (1) Tier I: Those who are at least high school graduates with a diploma from a public, private, virtual, distance, or legally sanctioned home school. Also includes high school seniors who are expected to complete high school, or those who failed to graduate but completed at least the 10th grade and earned 15 semester / 22 quarter hours of college-level credits (MCRC, 2014).
- (2) Tier II: Alternative credential holders who did not earn a high school diploma but who have a test-based equivalency diploma, a certificate of

attendance/completion of special education, or an approved occupational program certificate (MCRC, 2014).

- (3) Tier III: An individual who does not qualify as Tier I or Tier II (MCRC, 2014).

j. Gender

Identification as biological male or female at time of enlistment, as verified by the individual's birth certificate.

k. MCRD Discharge Date

The date that an individual is discharged from recruit training without having successfully graduated. This is referred to as MCRD attrition.

l. Program – PEF

This is the “Program Enlisted For” (PEF). All MEOP shippers have a PEF that begins with the identifier U2. The MCRISS query built to obtain the dataset for this study applied a filter for the “PEF” variable. Each PEF uniquely identifies which instrument the individual plays and whether or not their audition score is considered basically qualified or advanced proficiency. A derivative variable column was created to translate each PEF into the instrument's name and whether or not the PEF was basically qualified or advanced.

m. DEP Discharge Date

A separate query was run with DEP Date as the time parameter between FY05 and FY19 to explore what percentage of those contracted as MEOP applicants were later discharged without shipping to recruit training. It was discovered that there had been no applicants who enlisted with a MEOP PEF who were discharged from the Delayed Entry Program. This seemed illogical, and it was discovered that before a poolee is discharged from the DEP, their PEF is removed from their profile in the MCRISS RDBMS. While there have been MEOP poolees discharged from the DEP, it is not possible to query this information based on their PEF. This made it not possible to assess the DEP discharge

rate of MEOP poolees for comparison to the total population of MCRC poolees based on this study's query parameters.

n. Interview Date and New Working Applicant (NWA) Date

These variables were queried in the initial data set but were not used for analysis. While at a micro-level these are useful metrics for measuring the “contact-to-contract” (C-T-C) chain in the Enlisted Recruiting Process, it was deemed that they are not reliable metrics for analysis at the macro-level. In the student author's experience, these variables tend to be highly volatile for analysis because MCRC doctrine states that an interview is only valid for 90 days before the individual must be “re-interviewed,” while an NWA must be “scrubbed” if it is over 90 days old and the individual has not yet contracted (MCRC, 2016, p. 7-5). This results in multiple interview inputs and multiple NWA profiles for an individual that is “worked” for an extended period of time, which describes many MEOP applicants. With only the most recent date for each variable appearing in a query based on DEP Date or Ship Date, attempting to use this as a metric for C-T-C analysis was not practicable. An applicant may have been “worked” for well over a year, but their profile may indicate a C-T-C chain of well under 90 days. Furthermore, adhering to this MCRC policy for re-interview dates and NWA scrubbing varies from RS to RS, and may not be uniformly applied between commands.

o. Source and Activity

These two variables indicate by what means a recruiter obtained an individual's name for the purpose of prospecting (a list, a Priority Prospect Card, an electronic medium, a poolee referral, etc.) and what activity they used to contact them (telephone call, digital communication, area canvas, etc.) Like “Interview Date” and “NWA,” these variables were omitted from analysis due to questionable veracity. These inputs are based solely on recruiter input, and in the student author's experience an attempt to analyze these variables on a macro-level proves to be difficult. Recruiters have incentives to underreport sources such as those who “walk in” and over-report other activities such as “List/Telephone Call” or “Area Canvass” in order to inflate their productivity and efficiency in certain prospecting activities. These variables are mentioned only for the

purpose of answering any inquiries from readers who may wonder why they are absent from further analysis.

p. Current Zip Code

The self-reported zip code of the applicant at time of enlistment.

q. Race

The self-reported race of the applicant at time of enlistment.

r. Ethnic (MEPCOM)

The self-reported ethnicity of the applicant at time of enlistment based on United States Military Entrance Processing Command (MEPCOM) categories.

2. Explanation of Derivative Variables

The following variables were created as independent columns in the Excel dataset used for this research. Their purpose is to distill the raw data into a format that could be used to answer the research questions. A separate sheet was created in Excel that contained several reference tables used for the derivative variable formulas. A brief explanation of each variable is presented as appropriate along with a description of the variable's relevance and meaning. While the methods used to create certain variables could have been concatenated into a more condensed formula, the step-by-step "chunking" method used ensured that any errors could be resolved in a more compartmentalized manner.

a. Cal Ship Year

After standardizing the MCRISS SHIP DATE variable into a standard format of DD-MMM-YY, the CAL SHIP YEAR column was created in order to extract the calendar year the individual shipped, using the following formula format:

$$CAL\ SHIP\ YEAR = YEAR(SHIP\ DATE)$$

b. Cal Ship Mon

The calendar ship month the individual shipped, exported in a sequential numeric format, with January being “1” and December being “12.”

$$CAL\ SHIP\ MON = MONTH(SHIP\ DATE)$$

c. FY Ship Mon

MCRC operates on a fiscal calendar beginning in October and ending in September. Given this, variable columns were created to convert CAL SHIP MON to a fiscal year format with October being “1” and September being “12.” A lookup table was created to translate the calendar format to the fiscal format. The conversion utilized the Excel LOOKUP function.

d. FY Ship Year

This research required categorizing ship dates by fiscal year in the format YYYY. If the calendar month was from October through December (FY ship months 10, 11, or 12), the formula added one to the calendar year as a correcting factor. The following Excel formula was used to accomplish this:

$$FY\ SHIP\ YEAR = IF(MONTH(SHIP\ DATE) > 9, YEAR(SHIP\ DATE) + 1, YEAR(SHIP\ DATE))$$

e. Cal DEP Year

The calendar year of the MCRISSE DEP DATE variable. The same formulaic methodology was used as in CAL SHIP YEAR.

f. Cal DEP Mon

The calendar month of the MCRISSE DEP DATE variable. The same formulaic methodology was used as in CAL SHIP MON.

g. FY DEP Mon

The fiscal month of the MCRISSE DEP DATE variable. The same formulaic methodology was used as in FY SHIP MON.

h. FY DEP Year

The fiscal year of the MCRISS DEP DATE variable. The same formulaic methodology was used as in FY SHIP YEAR.

i. Days in DEP

The number of days between the DEP DATE and the SHIP DATE variables. This does not account for MEPS CONTRACT DATE and DEP and Hold adjustments.

j. MEPS Cal DEP Year

For the 722 records that had a MEPS CONTRACT DATE recorded in MCRISS, the year was converted using the same method as the CAL SHIP YEAR variable.

k. MEPS Cal DEP Mon

The fiscal year of the MEPS CONTRACT DATE, using the same method as the FY DEP MON variable.

l. MEPS FY DEP Year

The fiscal year of the MEPS CONTRACT DATE, using the same method as the FY DEP YEAR variable.

m. MEPS FY DEP Mon

The fiscal year of the MEPS CONTRACT DATE, using the same method as the FY DEP MON variable.

n. MEPS Days in DEP

The number of days between the MEPS CONTRACT DATE and the SHIP DATE variables. This derivative variable only applies to those instances that have a MEPS CONTRACT DATE recorded. Otherwise, the return is null.

o. Adj DEP Date

Some individuals in the primary dataset had a DEP Date, but no MEPS Contract Date. Others had a DEP Date and MEPS Contract Date. For those with a null value for MEPS Contract Date, the DEP Date may or may not be the same date depending if the individual was a DEP- and-Hold poolee. For those with a MEPS Contract Date different from the DEP Date, the MEPS Contract Date is the effective date of enlistment.

Because of these nuances, an adjustment factor column was created so that data analysis by contract date could be corrected for the up to 60 days difference between the DEP Date and MEPS Contract Date while accounting for MEPS Contract Date null values. The following Excel formula format was used:

ADJ DEP DATE =IF(MEPS CONTRACT DATE="",DEP DATE,MEPS CONTRACT DATE)

This ensured that a null value for MEPS CONTRACT DATE was returned as the DEP DATE and that a non-null value returned as the input MEPS Contract Date. ADJ DEP DATE can be understood as the effective date of contract for all individuals in the dataset. There were two anomalies found where the DEP Date preceded the MEPS Contract Date, which is not logically possible. Due to a myriad of possible MCRISS or USMEPCOM system irregularities that may have caused this issue, it was assumed that for these two instances that the MEPS Contract Date was equal to the DEP date. This allowed consistency in the dataset without sacrificing its integrity.

p. Adj Cal DEP Mon

The adjusted calendar DEP Month, using the methodology as similar variables.

q. Adj FY DEP Mon

The adjusted fiscal DEP Month, using the methodology as similar variables.

r. Adj FY DEP Year

The adjusted fiscal DEP year, using the methodology as similar variables.

s. *Adj Days in DEP*

The adjusted days in DEP, using the methodology as similar variables.

t. *Age at DEP*

The age of the individual on the date of their Adjusted DEP Date. The following Excel formula was used to return the number of years:

AGE AT DEP = NUMBER(DATEDIF(DATE OF BIRTH, ADJ DEP DATE, "Y"))

u. *Instrument*

The MCRISS variable “PROGRAM – PEF” returns a four-character alphanumeric identifier for the instrument an individual was contracted to play for the Marine Corps. MCO 1130.53R (Enlistment Incentive Programs) includes a table that translates each PEF into the instrument’s name (HQMC, 2012). A lookup table was created in Excel using the VLOOKUP function to allow PEF trends to be viewed without the need of continued reference. Three instances of the PEF U267 did not have a matching instrument identifier in MCO 1130.53R. The research team’s MCRC MEOP point of contact informed stated that this was a new job code for a vocalist, with the first occurrence of this PEF in the dataset being November 30, 2018.

v. *Advanced Qualification*

MEOP applicants who score at least 3.0 out of 4.0 on their musical audition (or 24 or higher under a recently updated scoring rubric) qualify for geographic duty station preference and are exempted from attending the Naval School of Music before reporting to their assigned fleet band. There is no assigned recruiting quota for “advanced” applicants nor is there a cap on how many may qualify for this preferential treatment in any given year. These individuals are identified by a separate PEF that uses a lettered coding system after the U2 identifier instead of a numbered coding. Using the lookup table created for the INSTRUMENT variable, the Excel XLOOKUP function was used to differentiate between “advanced” PEFs “basically qualified” PEFs.

w. *Education Code at Contract Truncated*

The MCRISS variable “Education Code at Contract” begins with a numeric identifier to show highest grade completed, but then also contains an additional alphanumeric identifier to indicate additional education statuses. For instance, “12L” indicates high school graduate from a traditional high school, while “12H” signifies a home school diploma and “12E” indicates general education degree (MCRC, 2014, p. 3-39). Due to the diversity of alphanumeric identifiers, this variable was created based on the highest grade completed regardless of type of degree conferred or by what means it was acquired. This allowed for a more digestible format for data analysis. The following formula was used:

$$EDUCATION\ CODE\ AT\ CONTRACT\ TRUNCATED = NUMBER(LEFT(EDUCATION\ CODE\ AT\ CONTRACT, 2))$$

Two individuals had null entries for the Education Code at Contract column. By looking at the variable education code for time of shipping, it was deduced that they were “17N” and “12L.” These were manually substituted into the dataset for Education Code at Contract. The “12L” was 19 years old at time of contract, and it is probable that the individual was a high school graduate at time of contract.

x. *Education Code Truncated*

This truncates the MCRISS variable “Education Code” in the same manner as described for “Education Code at Contract.” This is the verified education code of the applicant on the day they are shipped to recruit training.

D. DESCRIPTIVE STATISTICS

This section provides an analytical visualization of select variables, discovers data distributions, and identifies which variables ought to be considered for a more rigorous statistical analysis. This section explores the distribution of select variables in time-series charts, histograms, box and whisker plot, data tables, and frequency tables. Where it was deemed appropriate, a drill-down analysis in five-year (quinquennial) intervals was provided to help visualize changes in distributions over time. For this section, the

researchers referenced the “data understanding” and “data preparation” steps described by Chapman et al. in 2000, as well as the data description methods found in Keller’s 2018 book, and the Balakrishnan et al. work from 2013.

1. Number of MEOP PEFs Shipped by Fiscal Year

A pivot table was created that was organized by those shipped by fiscal year. It was found that between FY05-19, there were 1,899 shippers with a PEF code of U2XX. The yearly average was 127. Figure 13 visualizes these findings.

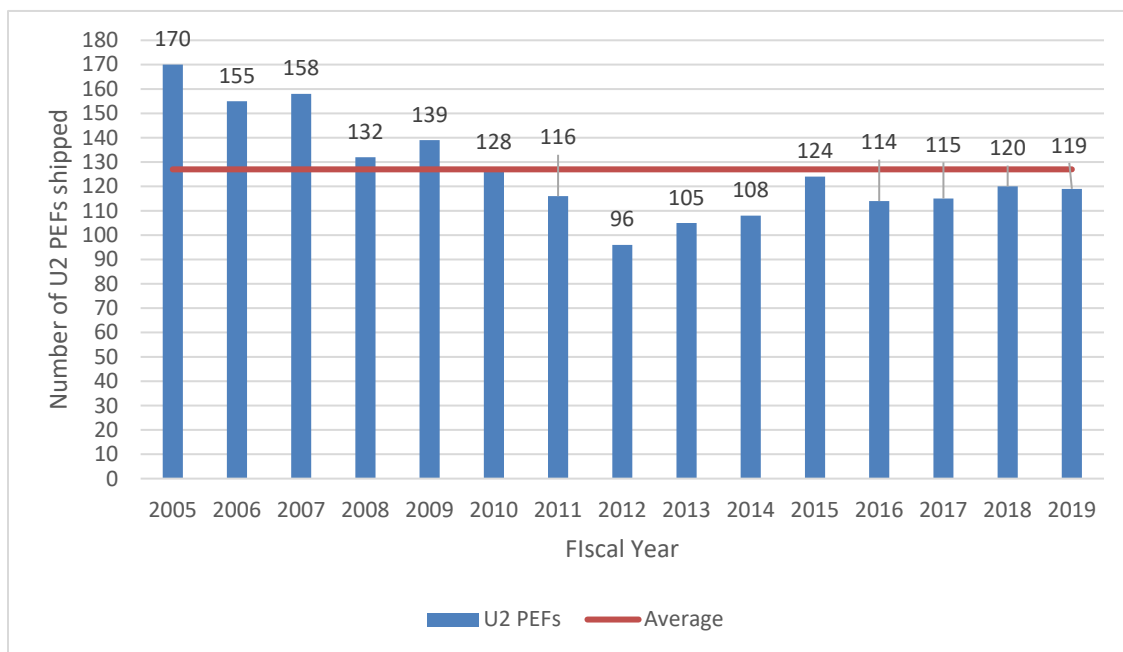


Figure 13. Distribution of U2 PEFs shipped by fiscal year.

2. Gender Proportion of MEOP Population Shipped

By visual inspection of Figure 14, the researchers could not discern a noticeable trend in gender composition of MEOP shippers over time, although there was a noted trough below the 15-year average proportion of 18.7% from FY12 and FY14. While MCRC does have a fixed annual female shipping mission, there are no female shipping mission requirements for musicians.

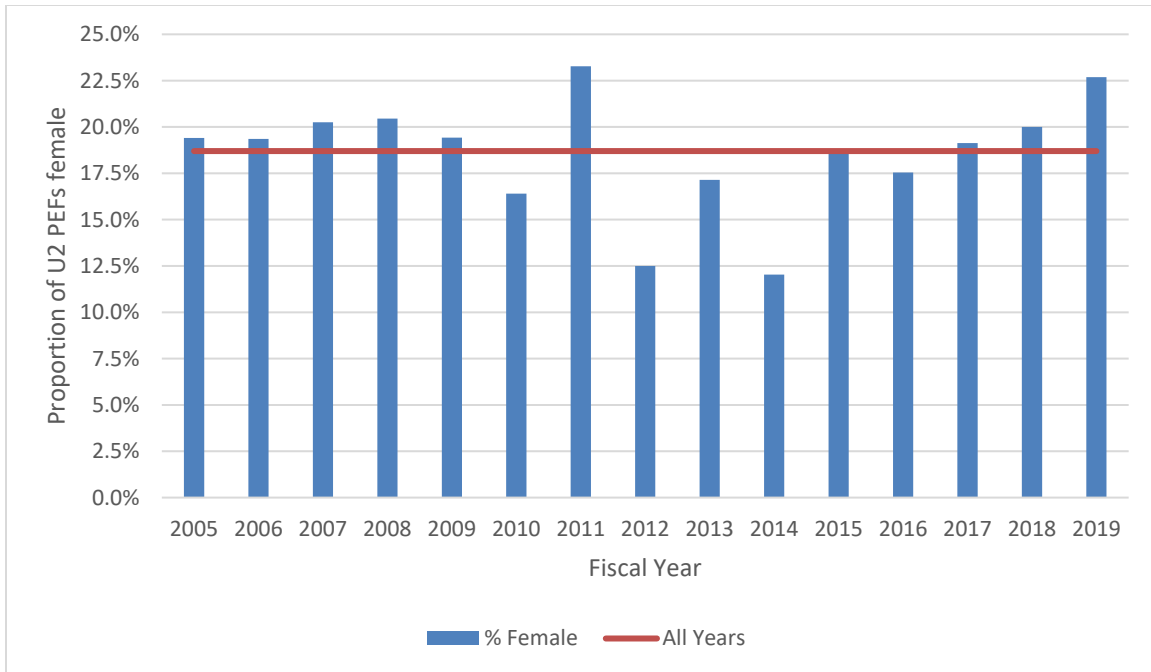


Figure 14. Proportion of female U2 PEFs by fiscal year.

3. Race and Ethnicity Descriptions

The Marine Corps enlisted recruiting mission does not have a racial or ethnic composition requirement, but the information is logged into each individual's MCRISS profile. A pivot table was created to analyze the race and ethnicity entries for MEOP shippers, with results shown in Table 6 and Table 7. Null entries were omitted from the tables for visual clarity.

Table 6. Race distribution of U2 PEFs by fiscal year.

Fiscal Year	American Indian or Alaska Native	Asian	Black or African American	Native Hawaiian or Pacific Islander	White
2005		1.18%	4.12%		94.71%
2006		0.65%	7.74%	0.65%	90.97%
2007		1.27%	7.59%		91.14%
2008	0.76%	5.30%	8.33%		85.61%
2009	1.44%	1.44%	7.91%		89.21%
2010	0.78%	2.34%	3.91%		92.97%
2011	0.86%	5.17%	6.03%		87.93%
2012	1.04%	4.17%	6.25%	3.13%	85.42%
2013		4.76%	11.43%		83.81%
2014		3.70%	3.70%		92.59%
2015		4.84%	5.65%		89.52%
2016		3.51%	9.65%	0.88%	85.96%
2017	0.87%	4.35%	6.09%	0.87%	87.83%
2018		3.33%	9.17%	0.83%	86.67%
2019	1.68%	5.04%	5.88%		87.39%
All Years	0.47%	3.21%	6.85%	0.37%	89.10%

Note: Data derived from Marine Corps Recruiting Command (2019, December 31).

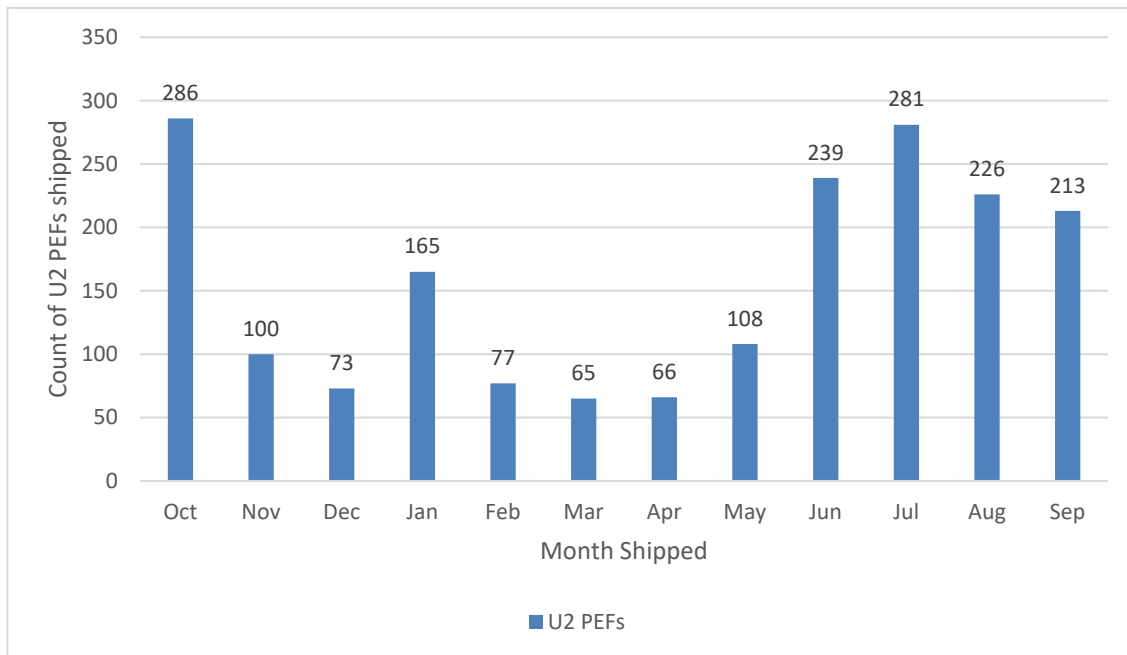
Table 7. Ethnic distribution of U2 PEFs by fiscal year.

Fiscal Year	Declined to respond	Hispanic or Latino	Not Hispanic or Latino
2005	2.94%	15.29%	81.76%
2006	2.58%	9.68%	87.74%
2007		12.66%	87.34%
2008	1.52%	16.67%	81.82%
2009	0.72%	12.23%	87.05%
2010	0.78%	19.53%	79.69%
2011		15.52%	84.48%
2012		13.54%	86.46%
2013		9.52%	90.48%
2014		14.81%	85.19%
2015		16.94%	83.06%
2016		18.42%	81.58%
2017		13.04%	86.96%
2018		18.49%	81.51%
2019		16.81%	83.19%
All Years	0.68%	14.81%	84.51%

Note: Data derived from Marine Corps Recruiting Command (2019, December 31).

4. Descriptions of Fiscal Year Ship Month Distributions

Figure 15 shows that over a 15-year period the highest shipping months for MEOP applicants were October and the last four months of the fiscal year, which are typically referred to as the “JJAS” fiscal trimester in MCRC. The results for JJAS seem to generally align with the seasonal nature of MCRC shipping missions, which are at their peak in the summer months of each fiscal year. January is often a higher shipping quota month, as well. October appears to be an outlier, as this is typically a comparatively lower shipping mission month in MCRC. The spike for MEOP shipping in October may demonstrate individual RSs having MEOP applicants already in their DEP at the beginning of a fiscal year and wanting to “get ahead” on their annual fiscal year shipping mission by shipping a MEOP applicant as soon as possible in the new fiscal year.

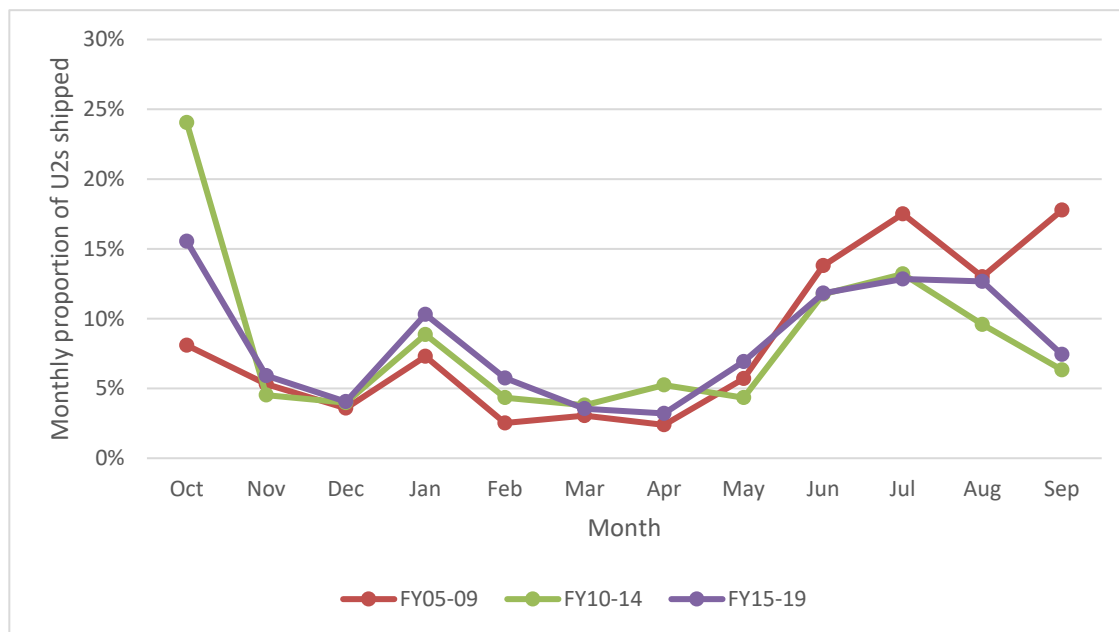


Note: Data derived from Marine Corps Recruiting Command (2019, December 31).

Figure 15. Distribution of U2 PEFs shipped by month for fiscal years 2005–2019.

Figure 16 shows the same data in a proportional quinquennial format. This figure shows that years FY05-09 had a higher ship rate for MEOP applicants in JJAS than the

other two FY groupings. In FY05-09, there was a higher proportion of MEOPs shipped in the last trimester of the fiscal year, which may indicate RSs pushing to make mission in the latter part of the year. Conversely, in FY10-14 and FY15-19, there was a higher proportion being shipped in October, which may demonstrate a shift in the ability to get ahead on the annual MEOP mission for some RSs and MCDs. FY10-14 saw the largest proportion for October, and a nearly 10% decrease from this peak in FY15-19.



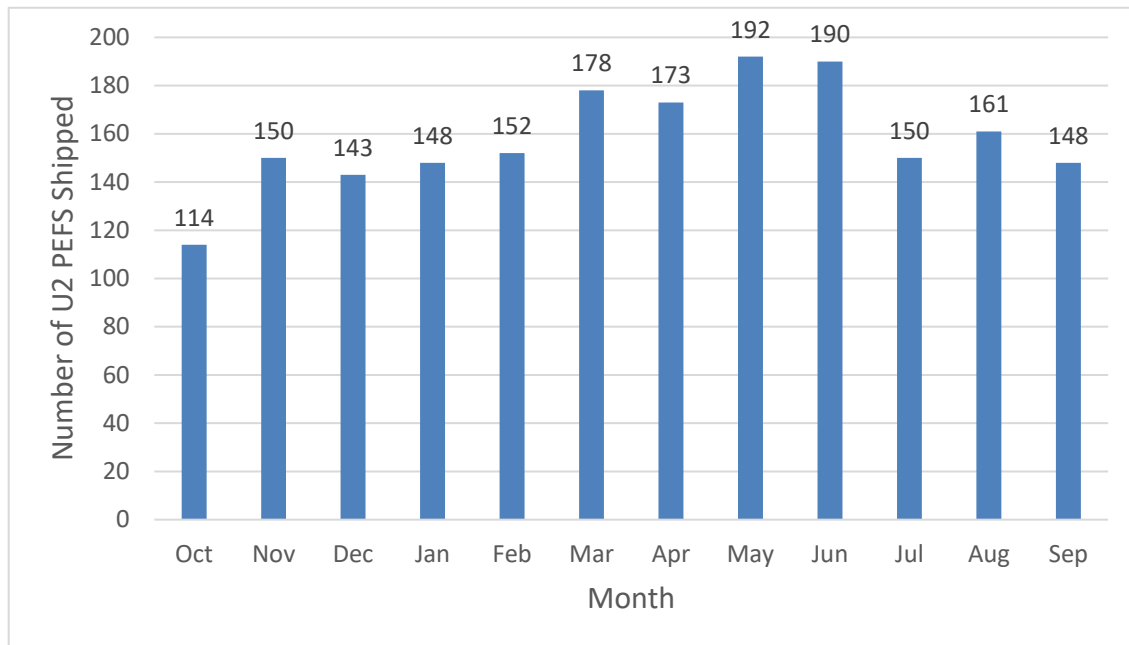
Note: Data derived from Marine Corps Recruiting Command (2019, December 31).

Figure 16. Quinquennial proportional distribution of U2 PEFs shipped by month for fiscal years 2005–2019.

5. Description of Fiscal Year Contract Month Distributions

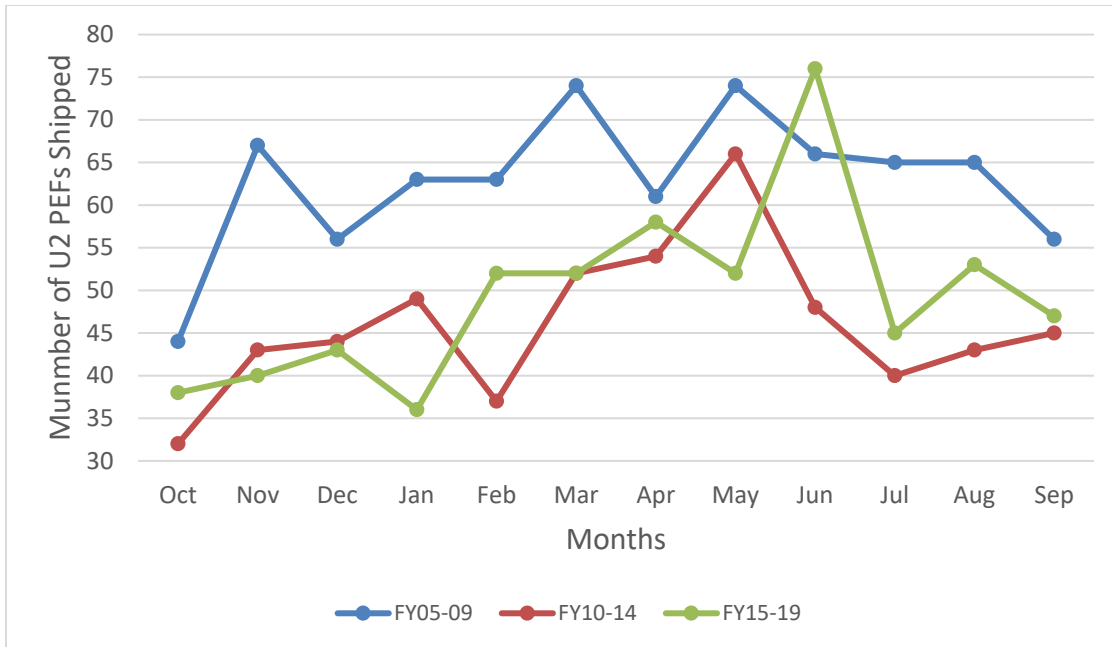
Figure 17 and Figure 18 show that over a 15-year period there was a trending increase in the number of MEOPs contracted each month between October and June, with a decrease in July through September. In the proportional view shown in Figure 19, there appears to be an increasing rate of contracting throughout the fiscal year, and a decrease in the last quarter. In FY15-19 there appears to be a spike in the annual proportion contracted in the month of June. These trends may indicate the fruits of prospecting

efforts that bloom later in the school year and fiscal year. The general decrease in the last quarter may indicate that mission has been made for many RSs, while stragglers struggle to make mission by the end of September as instrument availability becomes more scarce and increasingly difficult to fill.



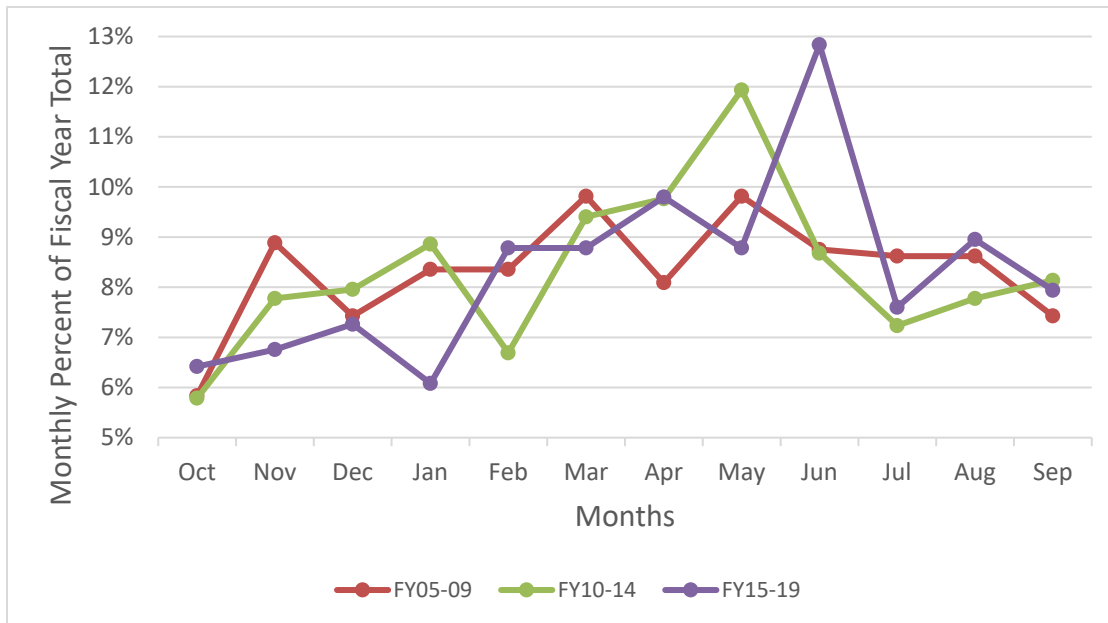
Note: Data derived from Marine Corps Recruiting Command (2019, December 31).

Figure 17. Distribution of U2 PEF DEP month for fiscal years 2005–2019.



Note: Data derived from Marine Corps Recruiting Command (2019, December 31).

Figure 18. Quinquennial distribution of U2 PEF DEP month for fiscal years 2005–2019.



Note: Data derived from Marine Corps Recruiting Command (2019, December 31).

Figure 19. Quinquennial proportional distribution of U2 PEFs DEP month for fiscal years 2005–2019.

6. Description Education Code at Contract Distributions

Table 8 shows a distribution of the variable Education Code at Contract (ECC) over time, while Table 9 shows the same data in a proportional format. Fiscal years 2018 and 2019 have been highlighted in red for education codes “11” and “12” to express doubts in their veracity. It seems that in FY05, high school seniors accounted for 64.1% of all education codes at contract. By FY17, this had trended downward to 27.0%. Table 10 groups education codes by “11-12,” “13-16,” and “17-19.” The data shown in Figure 20 and Figure 21 show the distribution of ECC in a format that visualizes the trends in education code distribution.

Table 8. Distribution of U2 PEF Education Code at Contract by fiscal year.

FY	<11	11	12	13	14	15	16	17	18	19	Total
2005	1	109	49	3	1		5	2			170
2006		87	54	3	1	3	7				155
2007		93	50	3	2	2	7	1			158
2008	1	65	56	2	1	2	5				132
2009		66	60	3	2	2	6				139
2010		59	58	2	1	2	6				128
2011		53	44	3	2	3	11				116
2012		32	44	3		5	12				96
2013		39	35		2	4	23	2			105
2014		36	48	2	2	3	12	5			108
2015		30	51	1	5	5	29	3			124
2016		26	51	1	5	9	21	1			114
2017		31	47	5	3	8	16	5			115
2018		9	77	2	4	5	18	4	1		120
2019		5	62	2	5	11	30	3		1	119

Note: Red text indicates questionable veracity of data.

Note: Data derived from Marine Corps Recruiting Command (2019, December 31).

Table 9. Proportional distribution of U2 PEF Education Code at Contract by fiscal year.

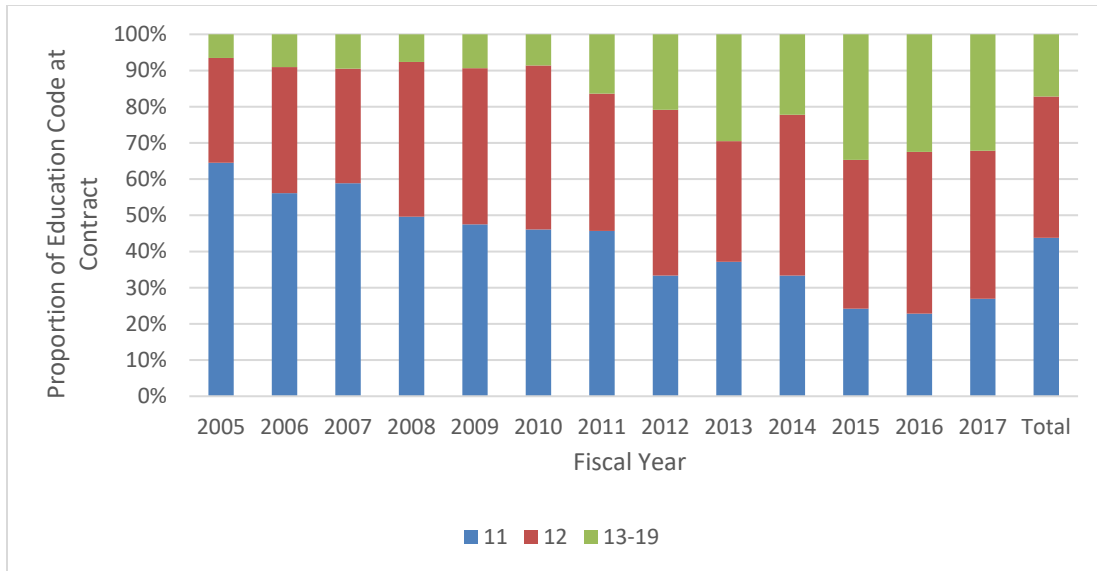
FY	<11	11	12	13	14	15	16	17	18	19
2005	0.6%	64.1%	28.8%	1.8%	0.6%		2.9%	1.2%		
2006		56.1%	34.8%	1.9%	0.6%	1.9%	4.5%			
2007		58.9%	31.6%	1.9%	1.3%	1.3%	4.4%	0.6%		
2008	0.8%	49.2%	42.4%	1.5%	0.8%	1.5%	3.8%			
2009		47.5%	43.2%	2.2%	1.4%	1.4%	4.3%			
2010		46.1%	45.3%	1.6%	0.8%	1.6%	4.7%			
2011		45.7%	37.9%	2.6%	1.7%	2.6%	9.5%			
2012		33.3%	45.8%	3.1%		5.2%	12.5%			
2013		37.1%	33.3%		1.9%	3.8%	21.9%	1.9%		
2014		33.3%	44.4%	1.9%	1.9%	2.8%	11.1%	4.6%		
2015		24.2%	41.1%	0.8%	4.0%	4.0%	23.4%	2.4%		
2016		22.8%	44.7%	0.9%	4.4%	7.9%	18.4%	0.9%		
2017		27.0%	40.9%	4.3%	2.6%	7.0%	13.9%	4.3%		
2018		7.5%	64.2%	1.7%	3.3%	4.2%	15.0%	3.3%	0.8%	
2019		4.2%	52.1%	1.7%	4.2%	9.2%	25.2%	2.5%		0.8%
Total	0.1%	39.0%	41.4%	1.8%	1.9%	3.4%	11.0%	1.4%	0.1%	0.1%

Note: Red text indicates questionable veracity of data.

Note: Data derived from Marine Corps Recruiting Command (2019, December 31).

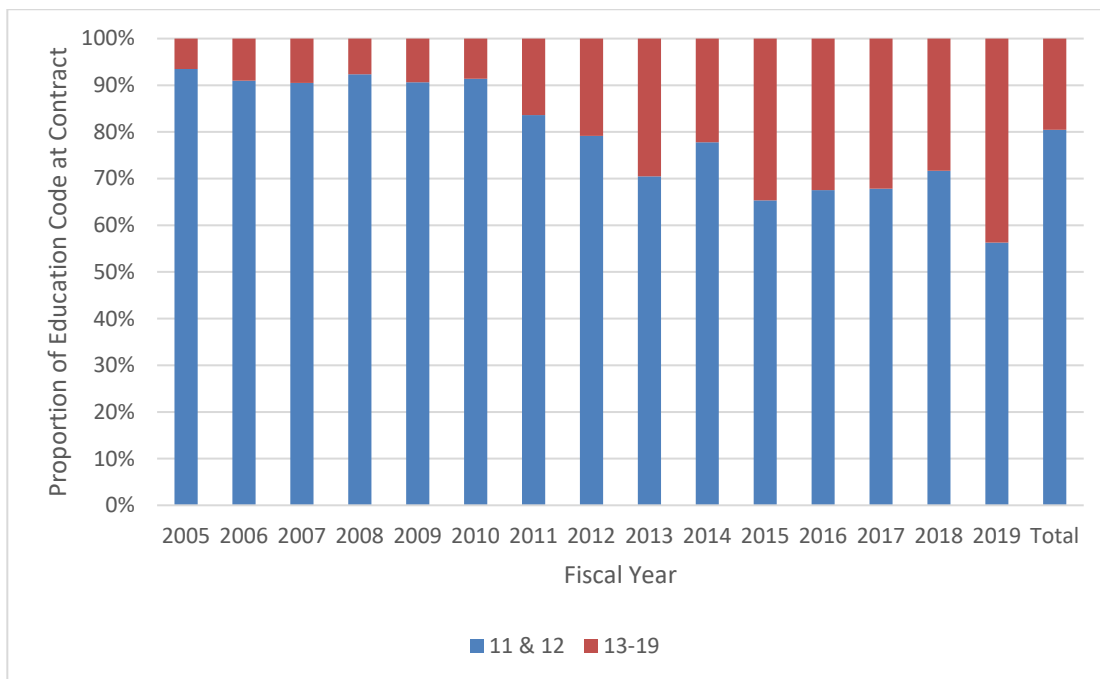
Table 10. Grouped proportional distribution of U2 PEF Education Code at Contract by fiscal year.

FY	≤12	13-16	17-19
2005	93.53%	5.29%	1.18%
2006	90.97%	9.03%	
2007	90.51%	8.86%	0.63%
2008	92.52%	7.58%	
2009	90.65%	9.35%	
2010	91.41%	8.59%	
2011	83.62%	16.38%	
2012	79.17%	20.83%	
2013	70.48%	27.62%	1.90%
2014	77.78%	17.59%	4.63%
2015	65.32%	32.26%	2.42%
2016	67.54%	31.58%	0.88%
2017	67.83%	27.83%	4.35%
2018	71.67%	24.17%	4.17%
2019	56.30%	40.34%	3.36%
Total	80.47%	18.06%	1.47%



Note: Data derived from Marine Corps Recruiting Command (2019, December 31).

Figure 20. Proportional distribution of grouped Education Code at Contract for fiscal years 2005–2017.



Note: Data derived from Marine Corps Recruiting Command (2019, December 31).

Figure 21. Proportional distribution of grouped Education Code at Contract for fiscal years 2005–2019.

7. Education Code at Shipping Distribution and Proportion

a. Education Code at Shipping by Fiscal Year

The “12 or Less” column found in Table 11 is inclusive of 17 entries of “11,” one “10,” and one “78.” These codes may represent individuals with less than a high school diploma but who otherwise hold a credential that qualifies them for enlistment. These codes have also been grouped into the “12” category for the sake of simplicity of interpretation. This data is shown proportionally in Table 12, and is grouped quinquennially and by education code categories in Figure 22. Like in previous views of the Education Code at Contract variable, there seems to be a similar increase in the proportion of MEOP shippers who have at least one year of college experience. Whether or not these shifts are statistically relevant are investigated in Chapter IV.

Table 11. Distribution of Education Code at Shipping by fiscal year.

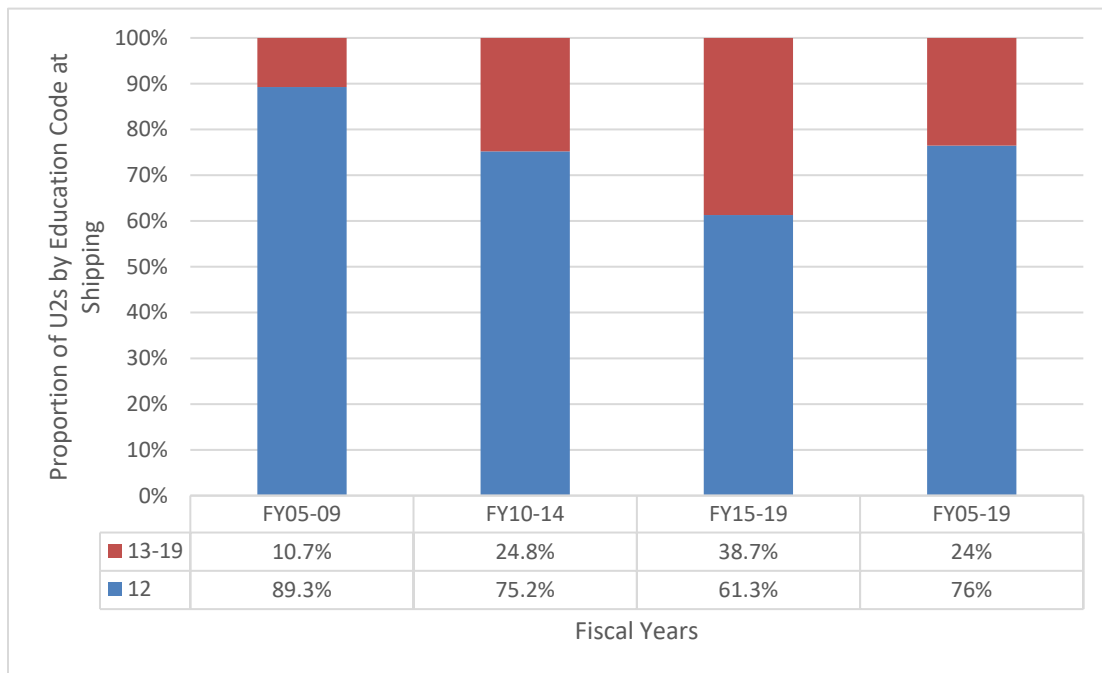
Fiscal Year	12 or Less	13	14	15	16	17	18	19	Total
2005	156	3	3	1	5	2			170
2006	137	2	3	5	8				155
2007	140	5	2	1	8	1	1		158
2008	121	2	2	2	5				132
2009	119	6	2	2	10				139
2010	111	6	1	2	8				128
2011	92	5	2	3	13		1		116
2012	64	4	4	3	20	1			96
2013	72	2	2	3	25	1			105
2014	77	3	2	4	17	5			108
2015	72	2	5	4	37	4			124
2016	70	3	7	10	23	1			114
2017	69	6	1	7	25	7			115
2018	85	2	4	5	19	4	1		120
2019	67	2	5	8	32	3	1	1	119
All Years	1452	53	45	60	255	29	4	1	1899

Note: Data derived from Marine Corps Recruiting Command (2019, December 31).

Table 12. Proportional distribution of Education Code at Shipping by fiscal year.

Fiscal Year	12 or Less	13	14	15	16	17	18	19	Total
2005	91.8%	1.8%	1.8%	0.6%	2.9%	1.2%			100.0%
2006	88.4%	1.3%	1.9%	3.2%	5.2%				100.0%
2007	88.6%	3.2%	1.3%	0.6%	5.1%	0.6%	0.6%		100.0%
2008	91.7%	1.5%	1.5%	1.5%	3.8%				100.0%
2009	85.6%	4.3%	1.4%	1.4%	7.2%				100.0%
2010	86.7%	4.7%	0.8%	1.6%	6.3%				100.0%
2011	79.3%	4.3%	1.7%	2.6%	11.2%		0.9%		100.0%
2012	66.7%	4.2%	4.2%	3.1%	20.8%	1.0%			100.0%
2013	68.6%	1.9%	1.9%	2.9%	23.8%	1.0%			100.0%
2014	71.3%	2.8%	1.9%	3.7%	15.7%	4.6%			100.0%
2015	58.1%	1.6%	4.0%	3.2%	29.8%	3.2%			100.0%
2016	61.4%	2.6%	6.1%	8.8%	20.2%	0.9%			100.0%
2017	60.0%	5.2%	0.9%	6.1%	21.7%	6.1%			100.0%
2018	70.8%	1.7%	3.3%	4.2%	15.8%	3.3%	0.8%		100.0%
2019	56.3%	1.7%	4.2%	6.7%	26.9%	2.5%	0.8%	0.8%	100.0%
All Years	76.5%	2.8%	2.4%	3.2%	13.4%	1.5%	0.2%	0.1%	100.0%

Note: Data derived from Marine Corps Recruiting Command (2019, December 31).

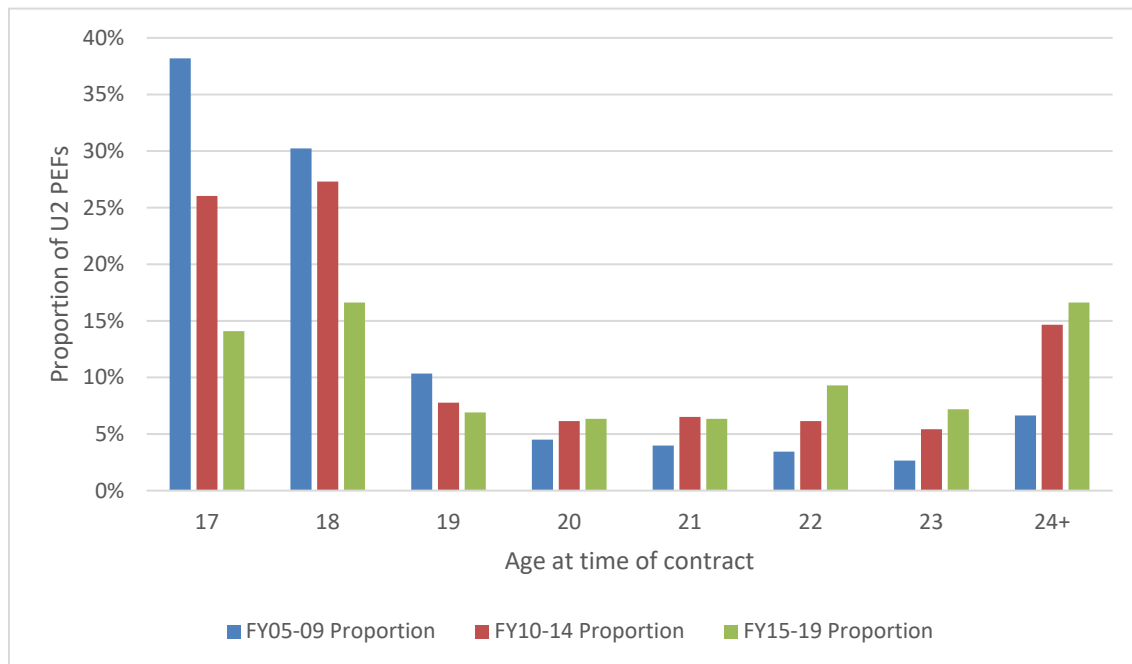


Note: Data derived from Marine Corps Recruiting Command (2019, December 31).

Figure 22. Quinquennial proportional distribution of grouped education codes at shipping.

8. Age at Time of Contract Descriptions

In addition to this study’s description of changes in education codes over time, it also investigated changes in age at time of enlistment. The researchers expected that any significant shifts in one variable would be positively correlated with a change in the other. Figure 23 shows a quinquennial breakdown of the age at time of contract. The most notable shifts over time appear to be a decrease in those contracted at the age of 17–19, and an increase in those ages 19–24. Notice that for the “24+” category, it rose from 7% in FY05-09 to 17% in FY15-19. This age group would indicate a rise in those of post-baccalaureate degree age, which appears to correspond to the increase in education code “16” over the same time period.

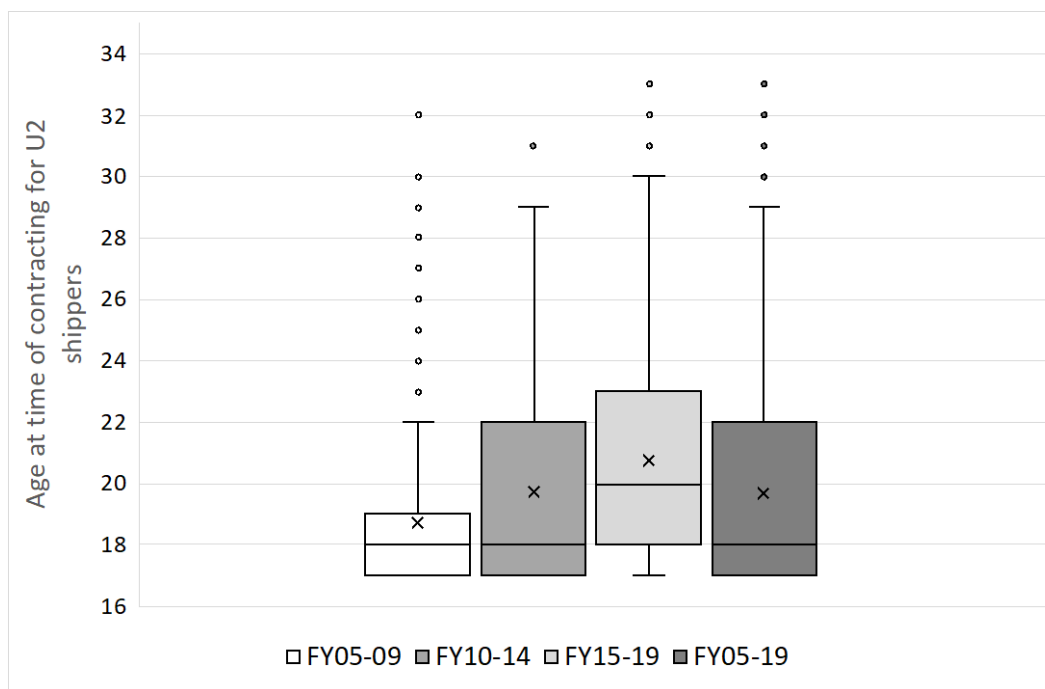


Note: Data derived from Marine Corps Recruiting Command (2019, December 31).

Figure 23. Quinquennial proportional distribution of U2 PEFs shipped by age at time of contract.

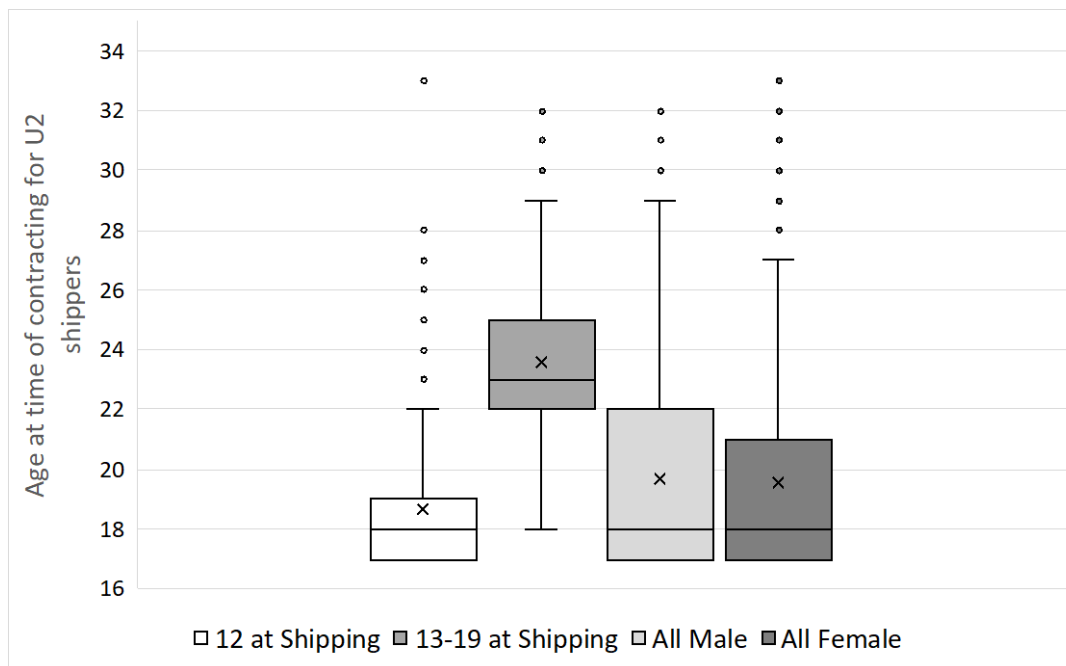
Figure 24 shows a shift in the median age of MEOP enlistees over time. The interquartile range for FY05-09 appears to be narrower than subsequent years. For instance, in FY05-09 75% of enlistees were between ages 17–19. By FY15-19, 75% were

between the age of 18–23, while 17-year-olds fell below the 25th percentile threshold. Upon visual inspection of these figures, it appears that there may be a significant shift in the age of the population at time of enlistment. Figure 25 shows that the median age of those who shipped as education code “12” is 18 at time of contracting, with 75% of the population being between 17–19 years-old at the time of contract. This would indicate that most of the population of “12s” enlisted during their senior year of high school or soon after graduating. The median age for college educated individuals was 23 years old, with 75% of that population enlisting between the ages of 22–25.



Note: Data derived from Marine Corps Recruiting Command (2019, December 31).

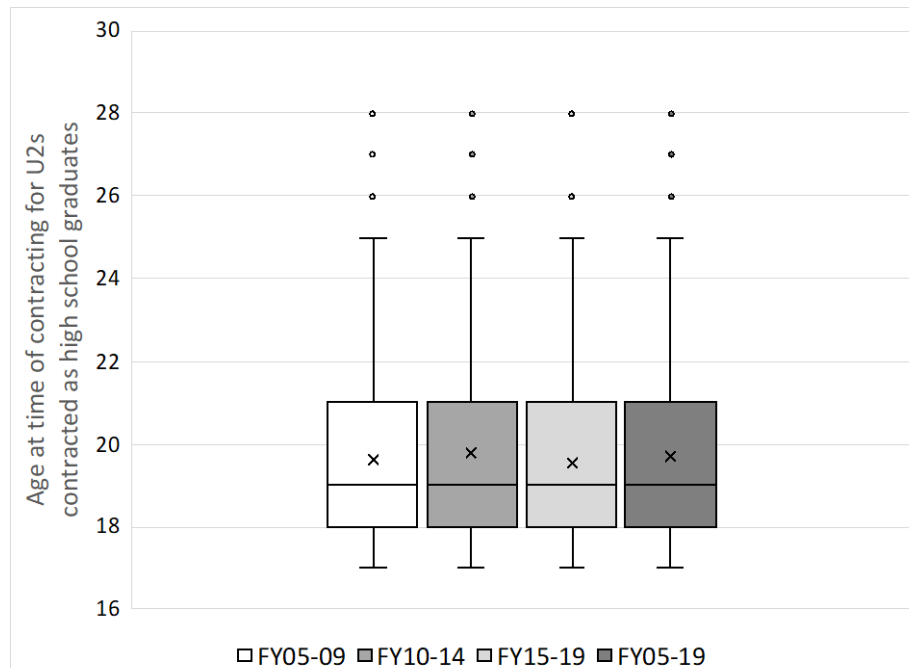
Figure 24. Age at time of enlistment for MEOP shippers.



Note: Data derived from Marine Corps Recruiting Command (2019, December 31).

Figure 25. Age at time contract by Education Code at Shipping for education and gender categories.

In regard to those who had an education code “12” at the time of contracting, the researchers were interested to know if the age of this particular subset has shifted over time. Based on Figure 26, it appears that there has not been a noticeable shift in the age distributions of those contracted as education code “12” over time. When also considering the data for this cohort shown in Table 9, the proportion of those contracted as a “12” appears to be relatively stable over time, as well.

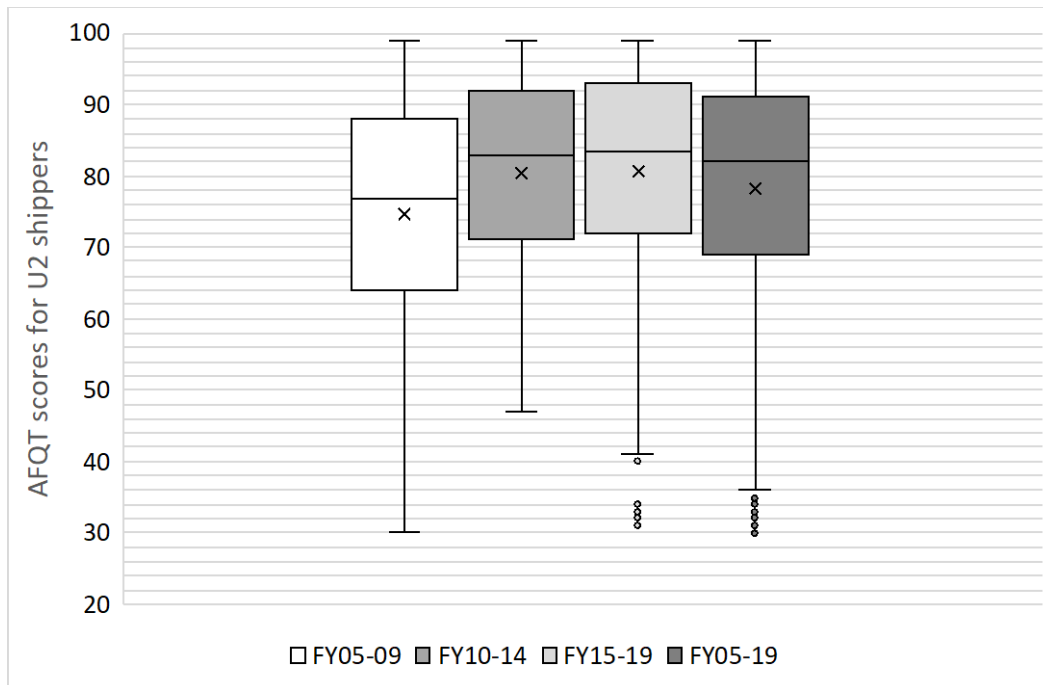


Note: Data derived from Marine Corps Recruiting Command (2019, December 31).

Figure 26. Age at time of enlistment for MEOP shippers identifying as education code “12” at time of contracting.

9. AFQT Score Descriptions

If there is a shift in the MEOP population toward those with higher levels of education, the researchers suspected that there may also be a shift in the AFQT scores. When visually inspecting Figure 27 it appears that there has been an increase in the mean and median scores over time, and a tightening of the range below the 25th percentile. Table 13 shows that the median and average AFQT scores for those who shipped as education codes “13-19” have a noticeably higher AFQT score than those who shipped as education code “12.” Figure 28 displays the average and median AFQT scores by gender and Education Code at Shipping. Here, the AFQT score for education codes “13-19” are noticeably higher than “12” at shipping while also having a more narrowly distributed range of scores.



Note: Data derived from Marine Corps Recruiting Command (2019, December 31).

Figure 27. Quinquennial description of AFQT scores for MEOP shippers.



Note: Data derived from Marine Corps Recruiting Command (2019, December 31).

Figure 28. AFQT score for education code at shipping by education code and gender.

Table 13. AFQT score descriptions by education code at shipping and gender.

FY05-FY19	12 at Shipping	13-19 at Shipping	Male	Female	12 Male	12 Female	13-19 Male	13-19 Female
Average AFQT	76.3	84.6	78.6	76.6	76.6	74.7	84.6	82.1
Median AFQT	79	88	82	80	79	76	88	84

Note: Data derived from Marine Corps Recruiting Command (2019, December 31).

10. AFQT Scores Under 50

To qualify for enlistment as a MEOP, the applicant must score at least 50 AFQT on the ASVAB, and would otherwise require a waiver to enlist (HQMC, 2012). Table 14 appears to show that there were a greater number of AFQT waivers between FY05-09, much less in FY10-14, and an increase in FY15-19. Table 15 displays the distribution of AFQT scores under 50 by gender and Education Code at Shipping.

Table 14. Count and percentage of AFQT scores under 50 by fiscal year.

Fiscal Year	AFQT Count	AFQT < 50	% AFQT <50
2005	170	15	8.8%
2006	155	14	9.0%
2007	158	17	10.8%
2008	132	22	16.7%
2009	139	3	2.2%
2010	128	1	0.8%
2011	116	0	0.0%
2012	96	0	0.0%
2013	105	1	1.0%
2014	108	0	0.0%
2015	124	0	0.0%
2016	114	1	0.9%
2017	115	0	0.0%
2018	120	4	3.3%
2019	119	13	10.9%
All Years	1899	91	4.8%

Note: Data derived from Marine Corps Recruiting Command (2019, December 31).

Table 15. AFQT statistics by Education Code at Shipping and gender.

FY05-FY19	12 at Shipping	13-19 at Shipping	Male	Female	12 Male	12 Female	13-19 Male	13-19 Female
Average AFQT	76	85	79	77	77	75	85	82
Median AFQT	79	88	82	80	79	76	88	84
% QT under 50	5.7%	1.8%	4.7%	5.1%	5.6%	6.4%	2.0%	1.1%

Note: Data derived from Marine Corps Recruiting Command (2019, December 31).

Table 14 shows that between FY10-17 there were only three individuals who enlisted that scored less than 50 AFQT. In FY18 alone there were four individuals with scores under 50, and 13 in FY19. This information was brought to the attention of the research team’s MEOP subject matter expert at MCRC to see if there was an explanation for this increase. In an email dated April 3, 2020, MSgt Stanley stated that there had been no change in AFQT score requirements, but that a recent clerical error in the Enlisted Incentive Program (EIP) publication erroneously omitted the AFQT score requirement. While other publications still listed the requirement, its omission in the EIP sent a false signal to the recruiting force that it was “open season” for sub-50 scores. Until this omission error was reconciled, as a measure of good faith MCRC approved AFQT waivers for “exceptionally qualified” individuals whose audition scores were at a SNCO-level of proficiency.

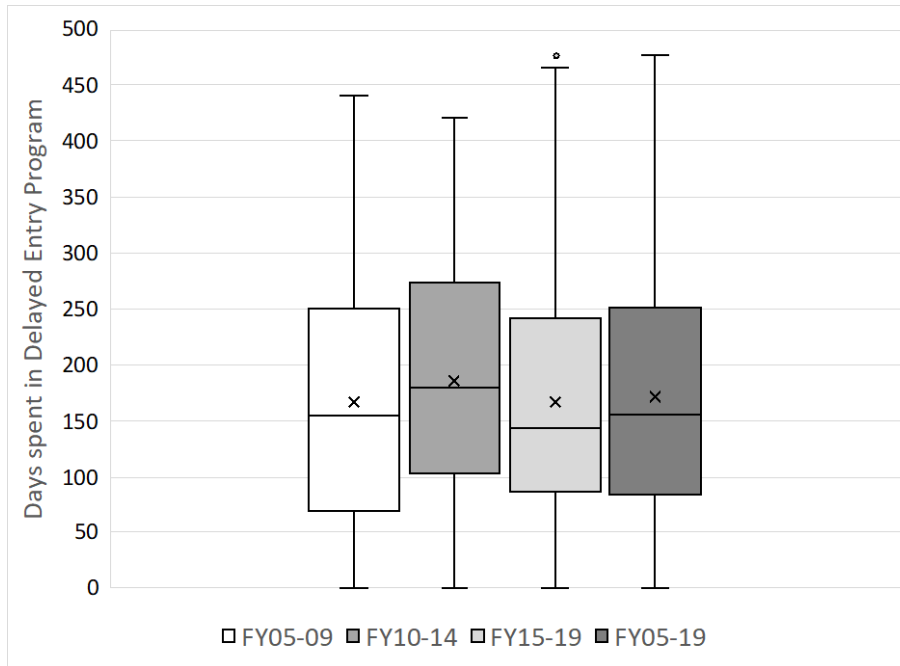
MSgt Stanley also noted that for those who were approved AFQT waivers but were not “exceptionally qualified” musicians, they had an above-average attrition rate from the Naval School of Music. It is worth noting that an exceptionally qualified musician with a subpar AFQT score would not risk attrition from NSOM because their advanced qualification status precludes them from having to attend NSOM for the BMC. An inspection of the dataset showed that between FY18-19, 15 individuals who were basically qualified based on their auditions had an AFQT score under 50. Of these, 13 were education codes “11” or “12” at contract while one was education code “14” and another was code “16.” Only two individuals in FY18-19 had an advance audition qualification and an AFQT score below 50. One was a 27-year-old with an education code of “16” and an AFQT score of 34, the other a 28-year-old with education code of

“17” and an AFQT score of 31. The research team was unable to validate NSOM attrition rates for the 15 individuals who scored below 50 AFQT and were basically qualified based on their musical audition status.

11. Days Spent in DEP by Fiscal Year

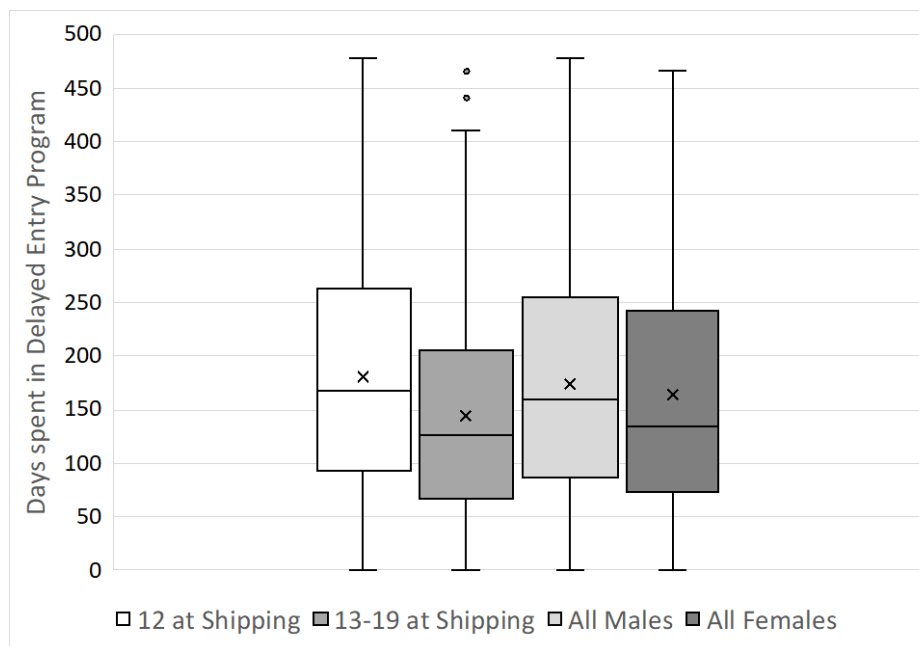
A measure of quality of the recruit pool and health of the Recruiting Station is how long individuals spend in the DEP before shipping. Generally speaking, those who spend less time in the DEP are believed to have a higher rate of non-EAS attrition from active duty (Peterson, Huff, & Quester, 2013). Bear in mind that by stating that less time in the DEP correlates to higher rates of active duty attrition may ignore other variables that may influence attrition outcomes such as moral waivers and AFQT scores (Jeppe, 2008). An RS that needs to ship individuals shortly after joining the DEP may indicate that they lack depth in their pool of recruits and are nearing what is referred to as a “direct ship” market, where an individual ship immediately after enlisting. In MCRC, a direct ship market is seen as an undesirable and precarious situation to be in.

Given this, the research team sought to investigate if there have been any significant shifts in time-in-DEP for the MEOP population. When viewing Figure 29, it does not appear that there has been a meaningful shift in the mean or median values for “Days in DEP,” although FY15-19 shows the smallest interquartile range, lowest mean, and lowest median of the three groupings. When viewing Figure 30 and Table 16, notice that that on average those who ship as Education Code at Shipping (ECS) “13-19” (median 126 days) spent less time in the DEP than ECS “12” (median 168 days). Females also spent less time than males in the DEP (median 159 days for males versus 134 for females). The higher median value for ECS “12” may be related to those who enlist late in their junior year or early in their senior year of high school, and may be skewing this grouping toward a higher median time-in-DEP. This hypothesis was not tested.



Note: Data derived from Marine Corps Recruiting Command (2019, December 31).

Figure 29. Days spent in Delayed Entry Program.



Note: Data derived from Marine Corps Recruiting Command (2019, December 31).

Figure 30. Days spent in DEP for Education Code at Shipping by education category and gender.

Table 16. Days spent in Delayed Entry Program by Education Code at Shipping and gender.

FY05- FY19	12 at Shipping	13-19 at Shipping	Male	Female	12 Male	12 Female	13-19 Male	13-19 Female
Average Days in DEP	180	144	174	163	181	175	148	130
Median Days in DEP	168	126	159	134	169	164	126	109

Note: Data derived from Marine Corps Recruiting Command (2019, December 31).

12. MCRD Attrition Descriptive Statistics

Another measure of DEP quality is recruit training attrition statistics. Table 17 describes the attrition rate for the MEOP population compared to the attrition rate for the entire MCRC population. Data for the MCRC population was obtained from querying 15 fiscal years of the “Commander’s Attainment Report” (CAR), which is considered a document of record by MCRC. The researchers also compared attrition for the female population of each category, which is generally understood to be higher than males. Over a 15-year period the MCRC attrition rate was 8.52%, and the MEOP attrition rate was 5.79%. For females, MCRC attrition rate was 14.08%, and for the MEOP female population 9.83%.

Table 17. Descriptive statistics for MCRD attrition by fiscal year.

FY	U2s Shipped	MCRD Discharges	% of U2s Discharged	MCRD Total Discharge Rate	Female U2 Shipped	% Female U2 Discharged	MCRD Female Discharge Rate
2005	170	14	8.24%	10.40%	33	6.06%	18.58%
2006	155	14	9.03%	10.93%	30	16.67%	16.43%
2007	158	7	4.43%	10.03%	32	15.63%	16.71%
2008	132	6	4.55%	8.89%	27	7.41%	20.62%
2009	139	7	5.04%	9.52%	27	11.11%	15.60%
2010	128	5	3.91%	8.61%	21	4.76%	16.15%
2011	116	8	6.90%	6.74%	27	22.22%	13.74%
2012	96	3	3.13%	5.52%	12	0.00%	10.56%
2013	105	6	5.71%	6.08%	18	5.56%	12.25%
2014	108	5	4.63%	7.23%	13	7.69%	14.52%
2015	124	10	8.06%	6.64%	23	13.04%	15.30%

FY	U2s Shipped	MCRD Discharges	% of U2s Discharged	MCRD Total Discharge Rate	Female U2 Shipped	% Female U2 Discharged	MCRD Female Discharge Rate
2016	114	3	2.63%	6.53%	20	5.00%	11.72%
2017	115	8	6.96%	8.36%	22	13.64%	13.06%
2018	120	5	4.17%	11.11%	24	8.33%	13.51%
2019	119	9	7.56%	10.53%	27	0.00%	12.43%
Total	1899	110	5.79%	8.52%	356	9.83%	14.08%

Note: U2 PEF data derived from Marine Corps Recruiting Command (2019, December 31).

Note: MCRD total discharge rates obtained from Marine Corps Recruiting Command (2019a, December 31).

The lower rate of attrition for the MEOP populations may have three explanations: 1) The overall moral, mental, or physical quality of MEOP recruits was higher than the general population; 2) There was a reluctance to discharge MEOP recruits due to their special knowledge, skills, and abilities (KSA) and comparative difficulty to recruit; 3) There are not enough individuals in the MEOP dataset for a valid comparison. The dataset used for this study identified 1,899 MEOPs shipped from FY05 through FY19. In the same time period, the total number shipped to recruit training by MCRC was 519,965, according to a sum of each annual MCRC CAR value for total shipped.

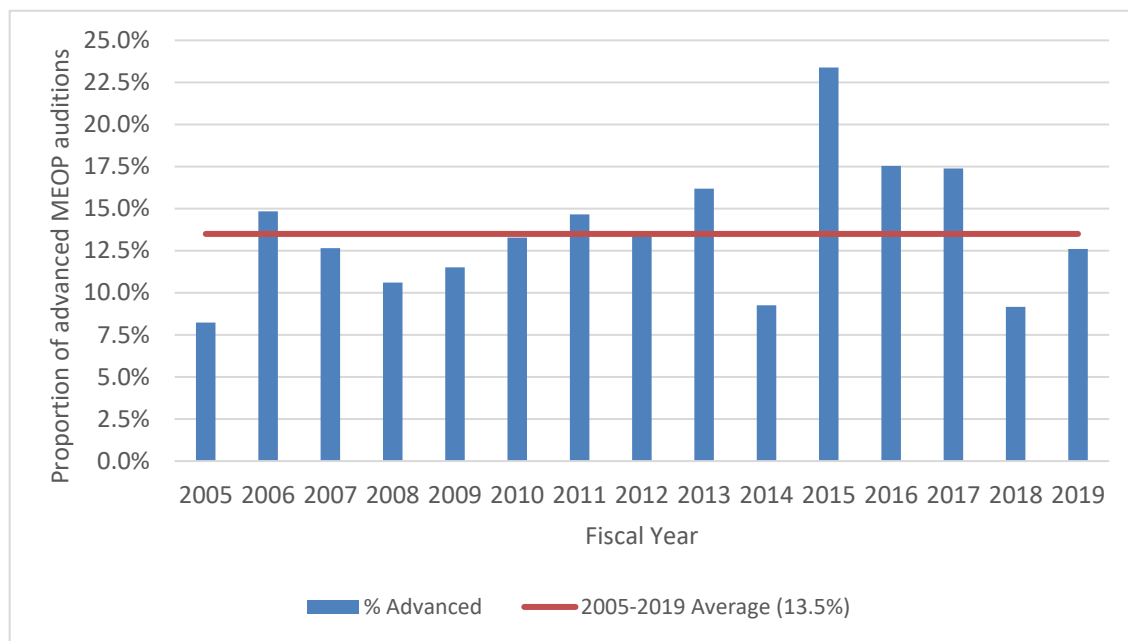
13. Proportion of Advanced Audition Qualification Status

As discussed earlier, MEOP applicants may qualify for additional enlistment incentives if their musical audition has a high enough qualifying score. Advanced qualification individuals do not attend the Naval School of Music for the Basic Music Course, and receive preferential selection of duty station. Using the derivative variables created for this study, the research team sought to inspect if there had been a change in the proportion of those qualifying as “advanced” over time. Cumulative proportional data by gender and Education Code at Shipping for this variable is shown in Table 18. Based on Figure 31, a clear trend was not apparent.

Table 18. Advanced PEF proportional distribution by education code at shipping and gender.

FY05-FY19	12 at Shipping	13-19 at Shipping	Male	Female	12 Male	12 Female	13-19 Male	13-19 Female
% Advanced	8.0%	31.3%	13.2%	14.9%	8.2%	7.2%	29.9%	37.0%
% of Advanced Population	45.3%	54.7%	79.3%	20.7%	37.9%	7.4%	41.4%	13.3%
% of Total Population	76.5%	23.5%	81.3%	18.7%	62.6%	13.9%	18.7%	4.8%

Note: Data derived from Marine Corps Recruiting Command (2019, December 31).



Note: Data derived from Marine Corps Recruiting Command (2019, December 31).

Figure 31. Proportion of U2 PEFs with advanced qualification code by fiscal year.

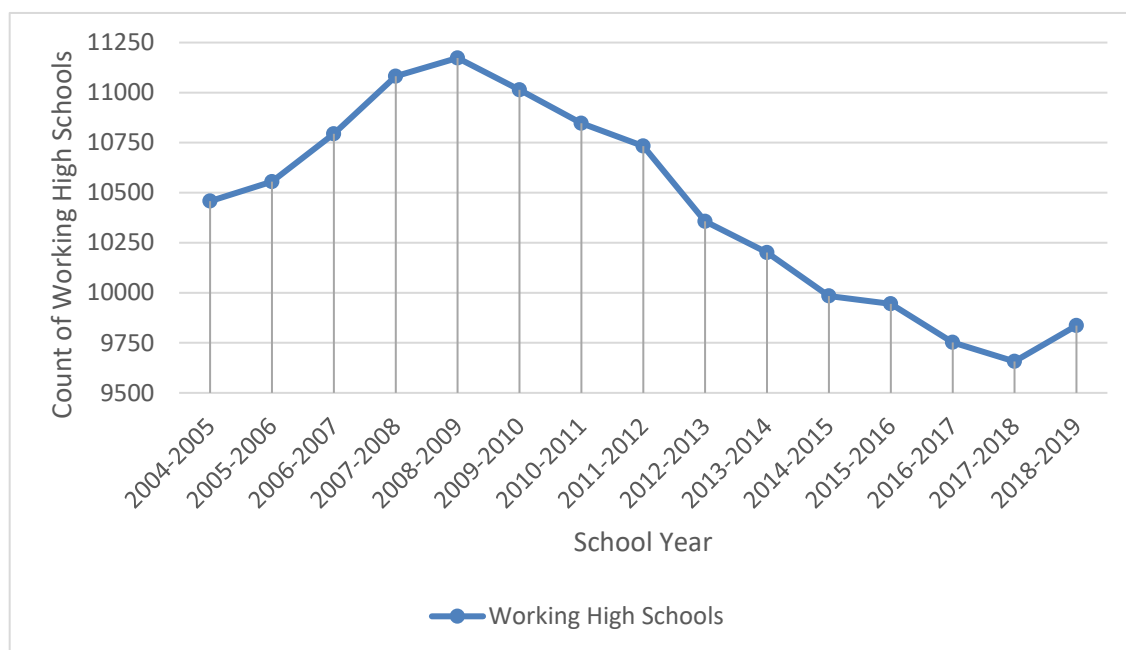
14. MEOP Band Talks and Active Working Schools

The research team manually extracted and compiled data from the MCRISS automated reports section that captures information about the number of working schools in MCRC. They expect that the number of working high schools relate to MCRC's overall annual mission and the number of recruiters on production in high schools. The

assumption was that the fewer working schools there were, the fewer seniors there were being exposed to the Marine Corps Music Program via band talks.

a. MCRC Working High Schools by School Year

Figure 32 shows that the number of working high schools peaked in the SY08-09 and decreased annually each year until SY18-19. It is possible that this is correlated to manpower end-strength requirements set by Congress and subsequent MCRC ROP manning levels, although this research did not seek to validate this hypothesis.



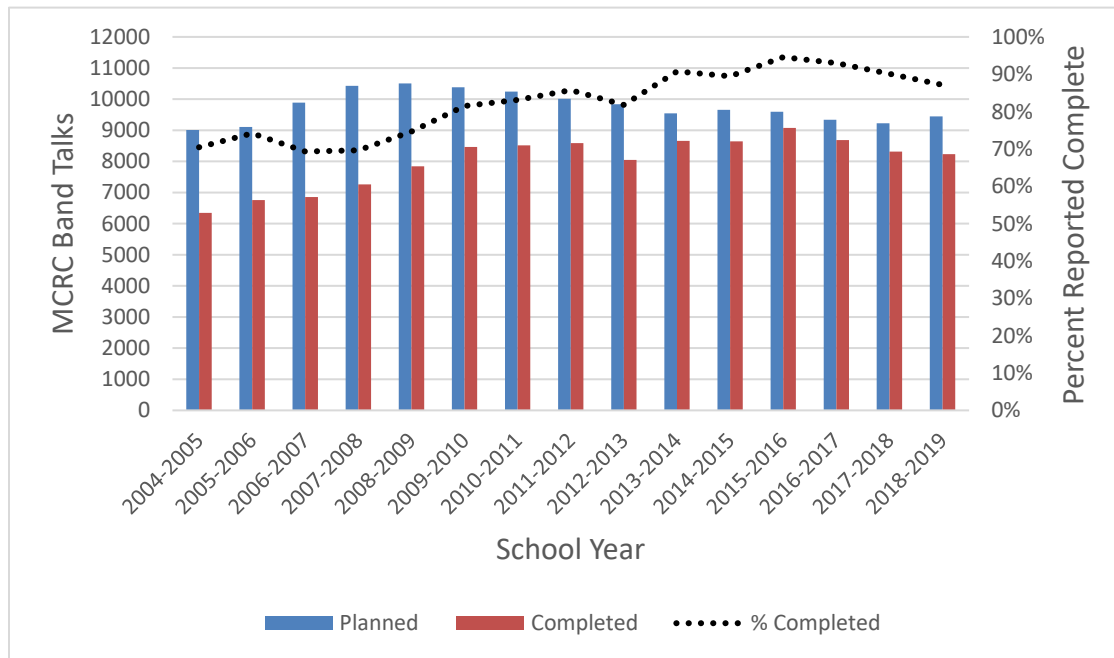
Note: Data derived from Marine Corps Recruiting Command (2019a, December 31).

Figure 32. Number of working high schools in MCRC for fiscal years 2005–2019.

b. High School Band Talks (HSBT) Planned, Completed, and Percent Completed

Data that showed the number of band talks that were planned and reported as complete were also obtained from MCRISS automated reports. Figure 33 visualizes this data, and there appears to be an increase in the percent reported as complete over time. This may be due to a combination of increased pressure to complete band talk

requirements, improved oversight by leadership, improved data input adherence, or an increase in “check in the box” band talks being falsely reported as completed to fulfill band talk requirements.



Note: Data derived from Marine Corps Recruiting Command (2019a, December 31).

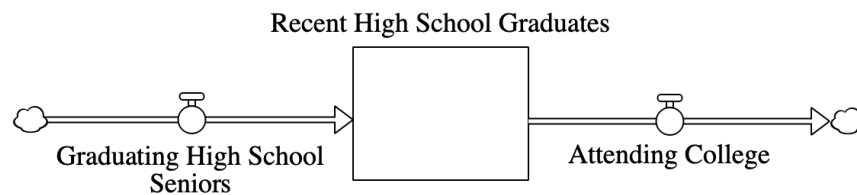
Figure 33. High school band talks planned and reported complete for fiscal years 2005–2019.

15. Zip Code Heat Map for MEOP Shippers

Using the Power Map function in Excel, the research team distributed the population of MEOPs by their reported zip code at time of contract. This visualization likely correlates to a combination of the “fair share” mission distribution that MCRC employs. When the distribution of MCRISS variable “State Code” was analyzed in a pivot table, it appeared that the state rankings generally reflected census data rankings for state population sizes for the 10–15 most populous states, which helps validate but does not prove the research team’s assumption. The Power Map figure can be found in Appendix B, Figure 48.

E. SUMMARY

Upon visual inspection it appears that there may have been a significant shift in the proportion of those contracted as high school seniors, recent high school graduates, and those with at least one year of college education. In particular, it appears that there has been a decrease in the proportion of MEOPs contracted as high school seniors and an increase in those who contracted with four years of undergraduate education, while the proportion of those contracted as high school graduates has seen less dramatic change. The research team suspected that while more high school seniors were not enlisting as MEOPs until they graduated, the proportion of high school graduates enlisting did not dramatically increase because of an increasing number of individuals enlisting after attending college. Figure 34 depicts the ECC “12” variable as a stock and flow “bucket” that is being filled with more “11s” on one end while being drained from its spigot by an increasing number of “12s” who will attend college instead of enlisting after graduation (Sternman, 2000). The net effect is that the “bucket” remains filled at a relatively stable volume. Age and AFQT scores also appear to have shifted toward older individuals with higher test scores, which may be related to a suspected shift in the highest level of education attained for MEOP applicants.



Note: Figure created using Stella Professional (version 1.8.2) software.

Figure 34. Stock and flow depiction of recent high school graduate population.

Regardless of this study’s assumptions based on the visual inspection of data, assumptions cannot be taken as statistical evidence of a market shifts. In Chapter IV,

hypotheses are developed and statistical tests are applied in order to identify definitive answers regarding shifts in the education code variable.

IV. ANALYSIS MODEL DEVELOPMENT AND RESULTS

A. CHOICE OF VARIABLES FOR ANALYSIS

Based on the descriptive statistics discussed in Chapter III, it was determined that the focal point of analysis in this chapter would be the variables “Education Code at Shipping” (ECS) and “Education Code at Contract” (ECC). These variables were chosen because it appears that there has been a meaningful shift in their proportional composition over time. Education code variables were chosen as the primary focus over ones such as age and AFQT score because categories such as these are likely dependent on education level. It seems intuitive that those with a higher level of education would be generally older in age and be disposed to having higher standardized test scores. Should the analysis of education codes not show any statistically significant shifts in proportion over time, it may be worthwhile to then explore categories such as age or AFQT score as a dependent variable to the independent variable of fiscal year.

As discussed in Chapter III, analysis of the ECC “11” variable are only performed between FY05 and FY17 because of unreliable data from FY18-19. The researchers also conducted an analysis on education code “12” for the ECC variable based on the discussion of the “bucket analogy” depicted in Figure 34. Based on the discussion of the ECC and ECS deltas that are shown in Table 4, a corrected data set was created to test for changes in proportion over time. Analysis of the ECS variable was conducted for the entire population from FY05 through FY19, and was grouped into those who shipped as education code “12,” “13-15,” “16,” and “17-19.” Education code “16” was broken out for an analysis independent from other college-level codes because the descriptive statistics found in Chapter III indicated that of all college-educated individuals, the “16” code appeared to have had a comparatively larger shift in proportion. This observation of the “16” category was supported by the findings of the MCRC-sponsored 2015 MEOP OPT (MCRC, 2015).

B. SPECIFICATION OF HYPOTHESES

1. Assumption of No Change in the Null Hypothesis

The hypotheses created for this research assume that there have not been any statistically significant market shifts in the MEOP population. The burden of proof was placed on the inquisitor to demonstrate that the null hypothesis cannot be supported. Any suggestions to alter MCRC recruiting strategies should be rooted in skepticism lest an assumption be false, a recommendation wrongly adopted, and subsequently negatively impact the ability to achieve mission attainment.

2. Burden of Proof to Reject the Null Hypothesis

“Two possible errors can be made in any test. A Type I error occurs when we reject a true null hypothesis, and a Type II error occurs when we do not reject a false null hypothesis” (Keller, 2018, p. 335). The probability of a Type I error is represented by the Greek letter α . The probability of a Type II error is represented by the letter β . A Type I error is considered to be a more serious error to make than Type II (Keller, 2018). The analogy Keller uses to illustrate this was the “courtroom analogy.” The judicial system of the United States assumes innocence of the accused and places the burden of proof on the prosecution. A Type I error would be to reject a true null hypothesis, as in the false conviction of an individual who is in fact innocent. A Type II error would be not rejecting a false null hypothesis. In other words, failing to convict a guilty individual.

The p -value in this study’s analyses can be understood to mean “the probability of observing a test statistic at least as extreme as the one computed given that the null hypothesis is true” (Keller, 2018, p. 342). The p -value statistic is understood as a comparison to α and has been described as “a measure of the amount of statistical evidence that supports the alternative hypothesis” (Keller, 2018, p. 342). The smaller the p -value probability, the smaller the likelihood that the extremity of the observance is due to chance. This research relied on Keller’s 2018 description of p -values, as described in Table 19.

Table 19. Describing p -values. Adapted from Keller (2018).

p -value	Statistical Significance	Weight of evidence to reject null hypothesis	Conclusion
$p < 0.01$	Highly significant	Overwhelming	Reject null hypothesis
$0.01 \leq p < 0.05$	Significant	Strong	Reject null hypothesis
$0.05 \leq p < 0.10$	Not significant	Weak	Fail to reject null hypothesis
$p \geq 0.10$	Not significant	Little to none	Fail to reject null hypothesis

C. EDUCATION CODE HYPOTHESES

This study's hypotheses were chosen in order to identify changes in the proportions of specific education codes or groupings of education codes over time by testing the independence of each fiscal year over the entirety of the dataset. The research team also tested quinquennial groupings of fiscal years in order to identify whether the comparison of certain periods yielded more or less change compared to other year groupings. This approach enabled a better understanding of when shifts may have occurred over broader timespans that may not be as apparent when comparing individual years. In particular, comparisons made to the period FY15-19 may shed light on the effect of policy changes implemented after the 2015 MEOP OPT (MCRC, 2015a). Any postulated causal relationships regarding this event would require an analysis beyond the scope of this research.

1. Hypothesis 1: Shift in Education Code at Contract “11”

a. Hypothesis 1a

- (1) H₀: There has not been a statistically significant change in the annual proportion of the Education Code at Contract category “11” from FY05 to FY17.
- (2) H₁: There has been a statistically significant change in the annual proportion of the Education Code at Contract category “11” from FY05 to FY17.

b. Hypothesis 1b

- (1) H₀: There has not been a statistically significant change in the quinquennially grouped proportions of the Education Code at Contract category “11” from FY05 to FY17.
- (2) H₁: There has been a statistically significant change in the quinquennially grouped proportions of the Education Code at Contract category “11” from FY05 to FY17.

2. Hypothesis 2: Shift in Education Code at Contract “12”

a. Hypothesis 2a

- (1) H₀: There has not been a statistically significant change in the annual proportion of the Education Code at Contract category “12” from FY05 to FY17.
- (2) H₁: There has been a statistically significant change in the annual proportion of the Education Code at Contract category “12” from FY05 to FY17.

b. Hypothesis 2b

- (1) H₀: There has not been a statistically significant change in the quinquennially grouped proportions of the Education Code at Contract category “12” from FY05 to FY17.
- (2) H₁: There has been a statistically significant change in the quinquennially grouped proportions of the Education Code at Contract category “12” from FY05 to FY17.

3. Hypothesis 3: Shift in Education Code at Shipping “12”

a. Hypothesis 3a

- (1) H₀: There has not been a statistically significant change in the annual proportion of the Education Code at Shipping category “12” from FY05 to FY19.
- (2) H₁: There has been a statistically significant change in the annual proportion of the Education Code at Shipping category “12” from FY05 to FY19.

b. Hypothesis 3b

- (1) H₀: There has not been a statistically significant change in the quinquennially grouped proportions of the Education Code at Shipping category “12” from FY05 to FY19.
- (2) H₁: There has been a statistically significant change in the quinquennially grouped proportions of the Education Code at Shipping category “12” from FY05 to FY19.

4. Hypothesis 4: Shift in Education Code at Shipping “13” through “15”

a. Hypothesis 4a

- (1) H₀: There has not been a statistically significant change in the annual proportion of the Education Code at Shipping categories “13” through “15” from FY05 to FY19.
- (2) H₁: There has been a statistically significant change in the annual proportion of the Education Code at Shipping categories “13” through “15” from FY05 to FY19.

b. Hypothesis 4b

- (1) H₀: There has not been a statistically significant change in the quinquennially grouped proportions of the Education Code at Shipping categories “13” through “15” from FY05 to FY19.
- (2) H₁: There has been a statistically significant change in the quinquennially grouped proportions of the Education Code at Shipping categories “13” through “15” from FY05 to FY19.

5. Hypothesis 5: Shift in Education Code at Shipping “16”

a. Hypothesis 5a

- (1) H₀: There has not been a statistically significant change in the annual proportion of the Education Code at Shipping category “16” from FY05 to FY19.

- (2) H₁: There has been a statistically significant change in the annual proportion of the Education Code at Shipping category “16” from FY05 to FY19.

b. Hypothesis 5b

- (1) H₀: There has not been a statistically significant change in the quinquennially grouped proportions of the Education Code at Shipping category “16” from FY05 to FY19.
- (2) H₁: There has been a statistically significant change in the quinquennially grouped proportions of the Education Code at Shipping category “16” from FY05 to FY19.

6. Hypothesis 6: Shift in Education Code at Shipping “17-19”

- (1) H₀: There has not been a statistically significant change in quinquennially grouped proportions of the Education Code at Shipping categories “17” through “19” from FY05 through FY19.
- (2) H₁: There has been a statistically significant change in quinquennially grouped proportions of the education code at shipping categories “17” through “19” from FY05 through FY19.

D. ANALYSIS MODEL SELECTION

After organizing data into the descriptive statistics shown in Chapter III, the research team then specified this study’s research hypotheses. In this section the steps of “select modeling techniques,” “generate test design,” “build model” and “assess model” as outlined in the CRISP-DM chart shown in Figure 10 were used as a reference to developing appropriate models and tests (Chapman et al., 2000). To inform the selection of appropriate statistical methods for this study, the research team referenced Keller’s 2018 work on managerial statistics.

1. Choice of Chi-Squared Statistic Analysis Model

To test for changes in proportions in education codes over each fiscal year, a chi-squared test of a contingency table was created. This test is “used to determine whether there is enough evidence to infer that two nominal variables are related and to infer that differences exist between two or more populations of nominal variables” (Keller, 2018, p. 527). While the variables found in the dataset for this research are more appropriately

classified as ordinal, the chi-squared test is still appropriate for this study's purposes. The chi-squared statistic is used to test for independence between fiscal years. This research's null hypotheses assumes fiscal year independence. In other words, each fiscal year's education code proportions are independent of other years, which means that no significant change between years is expected. A finding of dependence between fiscal years would indicate a shift in education code proportions over time.

The chi-squared test was not applied to the grouping of education codes "17-19" against the entire population because doing so would violate the "rule of five" that stipulates that expected values ought to have at least five occurrences to ensure an adequate approximation (Keller, 2018, p. 603). An inspection of Table 11 shows that only four out of 15 years achieved actual values of five or greater.

2. Choice of Z-Test Statistic Analysis Model for Measuring the Difference Between Two Proportions

To test the difference in education code proportions between groupings of fiscal years, a z-test was chosen because it is suited for the "inference about the difference between two population proportions" (Keller, 2018, p. 479). While chi-squared tests are able to answer whether or not significant change occurred over the entirety of the dataset, the z-test is able to show if more or less change is occurring at different rates over different time periods. For example, if the chi-squared test showed that there had been a significant change in the proportion of college graduates contracted over the last 15 years, the z-test can be used to test for significant change between FY05-09 and FY10-14, and between FY10-14 and FY15-19. Unlike the chi-squared test, the z-test may be applied to the "17-19" education code category despite its low rate of occurrences.

E. ANALYSIS MODEL DEVELOPMENT

1. Development of Chi-Squared Analysis Model

All statistical analysis for this research was performed in Microsoft Excel version 16.36, 16.37, and 16.38. The Excel function utilized for this study was the CHISQ.TEST function, which Excel describes as returning the "value from the chi-squared (χ^2) distribution for the statistic and the appropriate degrees of freedom." Excel further

explains that the function “returns the probability that a value of the χ^2 statistic at least as high as the value calculated by the above formula could have happened by chance under the assumption of independence.” The equation the CHISQ.TEST function relied on to compute the chi-squared statistic was:

$$\chi^2 = \sum_{i=1}^r \sum_{j=1}^c \frac{(A_{ij} - E_{ij})^2}{E_{ij}}$$

The variables for this equation are defined as follows:

- (1) r = number of rows = education code grouping
- (2) c = number of columns = fiscal year
- (3) A_{ij} = actual frequency in the i^{th} row, j^{th} column
- (4) E_{ij} = expected frequency in the i^{th} row, j^{th} column

The actual frequencies calculated in this study’s models were found by computing the sums of each education code grouping per fiscal year. For example, for the column of year FY05 the actual value for education code “12” was 156, and the actual value for “all other codes” was 14, for a total column sum of 170. To calculate expected frequencies, Keller’s 2018 equation for the expected frequencies of a contingency table was used:

$$E_{ij} = \frac{(\text{row } i \text{ total}) \times (\text{column } j \text{ total})}{\text{sample size}}$$

To continue from the previous example, imagine that the sum of the cells in the row for education code “12” for all 15 fiscal years was 1,452 and the sum of the cells in the row for “all other codes” was 447, for a total sample size of 1,899. The expected value for education code “12” in FY05 would be:

$$E_{ij} = \frac{(\text{row } i \text{ total}) \times (\text{column } j \text{ total})}{\text{sample size}} = \frac{1,452 \times 170}{1,899} = 129.98$$

This equation is then applied across the entire contingency table to produce the correlating expected value for every actual value per fiscal year. The inputs necessary for the CHISQ.TEST function are the sum of all actual ranges and sum of all expected

ranges. These values are calculated according to the CHISQ.TEST function parameters, and an output value is provided by the Excel function.

The output value of the CHISQ.TEST function is the χ^2 statistic p -value. While not necessary for interpretation, the χ^2 test statistic value was also calculated. To achieve this, the CHISQ.INV.RT function was used. The input for this function is the output of the CHISQ.TEST function and the calculated degrees of freedom (ν). To calculate the degrees of freedom in a contingency table, the following equation Keller's 2018 work was used:

$$\nu = (\text{row } i \text{ total} - 1) \times (\text{column } j \text{ total} - 1)$$

To count rows and columns in the Excel model, the COUNTA function was used. For example, if a contingency table has two rows and 15 columns, ν would be calculated as:

$$\nu = (2 - 1) \times (15 - 1) = 14$$

Performing these calculations manually for a large contingency table can be tedious. The research team's goal was to create an analysis model that would be easily reproducible in Excel. By properly applying the Excel functions and chi-squared equation, the research team created a spreadsheet that distilled the data found in Table 11 into a 2x15 contingency table that produced all expected values, applied the CHISQ.TEST and CHISQ.INV.RT functions, and restated the output of these functions in terms of the parameters established in Table 19. The exception to this is a 2x13 table used for the ECC variable for education codes "11" and "12" for FY05-17. The model also shows each fiscal year's actual frequency as a percentage for situational awareness. While it was not visually practicable to show the formulas for each cell in the chi-squared model, the Excel spreadsheet model output for each test can be found in the appendices.

2. Development of Z-Test Analysis Model

While the basic version of Excel software is capable of performing z-test functions for a variety of data sets, there is not a standard function that is able to calculate the inference about the difference between two population proportions. Given this, it was

necessary to manually construct a model using the equations provided by Keller in 2018. As previously explained, the null hypotheses assume independence between fiscal year groupings, meaning that no change is expected in the proportion of education codes across fiscal years. Mathematically, this assumption can be written as:

$$H_0: p_1 - p_2 = 0$$

$$H_1: p_1 - p_2 \neq 0$$

Given these assumptions, the appropriate test statistic according to Keller is:

$$z = \frac{(\hat{p}_1 - \hat{p}_2) - (\hat{p}_1 - \hat{p}_2)}{\sqrt{\hat{p}(1 - \hat{p})\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$$

While this equation describes samples of populations and this study's dataset represents the entire population of MEOPs shipped from FY05 to FY19, this does not affect the choice of the equation nor the outcome of the test. The variables for this equation were defined by Keller in 2018 as:

- (1) z = test statistic
- (2) $\hat{p}_1$ = sample proportion of the first population
- (3) $\hat{p}_2$ = sample proportion of the second population
- (4) $\hat{p}$ = total proportion of both samples
- (5) n_1 = total count of the first sample population
- (6) n_2 = total count of the second sample population

To calculate the z -statistic for quinquennial fiscal year groupings, this research used a “chunking” approach in Excel that builds the equation in small pieces before calculating the final z -statistic. This output in of itself is not useful for interpretation without further manipulation, so it was necessary to apply the Excel function NORM.S.DIST. Excel explains that this function “returns the standard normal distribution (has a mean of zero and a standard deviation of one)” and to “use this function in place of a table of standard normal curve areas.” The input variables for this

function are the calculated value of the z -statistic and a choice between a cumulative or noncumulative output value. The research team was only interested in the noncumulative value, which required an input of “FALSE.” The NORM.S.DIST function operates by calculating the standard normal density function, which Excel defined as:

$$f(z) = \frac{1}{\sqrt{2\pi}} e^{-\frac{z^2}{2}}$$

To ensure that readers can validate and replicate the models created by this research, Figure 35 displays the z -statistic model with “show formulas” formatting turned on. Columns and rows have been labeled to allow for cell referencing. A truncated view of this model’s outputs will be provided for all other tests performed.

	B	C	
2	FY05-FY09 vs FY10-FY14		
3	Education Code for x	<= 12	
4	x1	673	
5	n1	754	
6	x2	416	
7	n2	553	
			OUTPUT
9	p1	=C4/C5	0.8926
10	p2	=C6/C7	0.7523
11	p	=(C4+C6)/(C5+C7)	0.8332
12	p1-p2	=C9-C10	0.1403
13	p(1-p)	=C11*(1-C11)	0.1390
14	1/n1	=1/C5	0.0013
15	1/n2	=1/C7	0.0018
16	(1/n1)+(1/n2)	=C14+C15	0.0031
17	[p(1-p)]*[(1/n1)+(1/n2)]	=C13*C16	0.0004
18	sqrt([p(1-p)]*[(1/n1)+(1/n2)])	=SQRT(C17)	0.0209
20	z statistic	=C12/C18	6.7726
21	p-value	=NORM.S.DIST(C20,FALSE)	6.1158E-11
22	p-value probability	=IF(C21<0.01,"<1.00%",C21)	
23	=IFS(C21>=0.1,"Little to no evidence",C21>=0.05,"Weak evidence",C21>=0.01,"Strong evidence",C21>0,"Overwhelming evidence")		
24	=IFS(C21>=0.1,"Fail to reject null hypothesis",C21>=0.05,"Fail to reject null hypothesis",C21>=0.01,"Reject null hypothesis",C21>0,"Reject null hypothesis")		

Figure 35. Excel z-statistic model template with formulas shown.

F. ANALYSIS MODEL RESULTS OUTPUT

This section provides this study's model outputs, which include numeric values for the chi-squared statistic, z-statistic, associated *p*-values, weight of evidence, statistical significance, and conclusions based on the hypotheses' rejection criteria. Chapter V will expound upon these findings in greater detail by providing contextualized interpretations, conclusions, and recommendations.

1. Chi-Squared Model Outputs

A summarization of results can be found in Table 20, and a full view of the model outputs can be found in the appendices. There was overwhelming evidence to reject the null hypotheses in every instance except Hypothesis 2a, in which little to no evidence was found to support rejection of the null hypothesis. Findings for Education Code at Shipping "12" aligns with the "bucket" analogy that describes the stock of those contracted as code "12" as being in a relatively steady state as the proportions of "11" decreased and those greater or equal to "13" increased.

Table 20. Chi-squared model output for education code shift hypotheses.

Hypothesis	Education code	χ^2 statistic	p-value	Significance	Weight of evidence	Hypothesis Conclusion
Hypothesis 1a ^{2,3}	11	119.47	<0.01	Highly significant	Overwhelming	Reject null
Hypothesis 2a ^{2,3}	12 ¹	16.27	≥0.10	Little to none	Little to none	Fail to reject null
Hypothesis 3a	≤ 12	173.07	<0.01	Highly significant	Overwhelming	Reject null
Hypothesis 4a	13-15	29.43	<0.01	Highly significant	Overwhelming	Reject null
Hypothesis 5a	16	130.00	<0.01	Highly significant	Overwhelming	Reject null

¹ Values for this category was corrected based on the education code deltas shown in Table 4.

²Hypothesis 1a and Hypothesis 2a use the variable “Education Code at Contract.” All other hypotheses reference “Education Code at Shipping”

³Hypothesis 1a and Hypothesis 2a cover fiscal years 2005 through 2017, all other hypotheses reference fiscal years 2005 through 2019.

Note: Data derived from Marine Corps Recruiting Command (2019, December 31).

2. Z-Statistics Model Outputs

The models for Hypothesis 1b and Hypothesis 2b rely on the MCRISS variable “Education Code at Contract” (ECC) for FY05-17. All other hypotheses rely on the “Education Code at Shipping” (ECS) variable for FY05-19.

a. Model Output for Hypothesis 1b

This model shows that there was overwhelming evidence to support rejection of the null hypothesis for each year grouping comparison. From FY05-09, 55.7% of those

contracted were recorded as being education code “11” at contract. By FY15-17, the proportion had declined to 24.7%. Results are shown in Figure 36.

FY05-FY09 vs FY10-FY14		FY10-FY14 vs FY15-FY17		FY05-FY09 vs FY15-FY17	
Education Code for x	11	Education Code for x	11	Education Code for x	11
x1	420	x1	219	x1	420
n1	754	n1	553	n1	754
x2	219	x2	87	x2	87
n2	553	n2	353	n2	353
p1	0.5570	p1	0.3960	p1	0.5570
p2	0.3960	p2	0.2465	p2	0.2465
p	0.4889	p	0.3377	p	0.4580
z statistic	5.7530	z statistic	4.6420	z statistic	9.6656
p-value	2.5943E-08	p-value	8.3535E-06	p-value	2.0623E-21
p-value probability	<1.00%	p-value probability	<1.00%	p-value probability	<1.00%
Overwhelming evidence		Overwhelming evidence		Overwhelming evidence	
Reject null hypothesis		Reject null hypothesis		Reject null hypothesis	

Note: Data derived from Marine Corps Recruiting Command (2019, December 31).

Figure 36. Model output for Hypothesis 1b.

b. Model Output for Hypothesis 2b

There was little to no evidence to support rejection of the null hypothesis for each year grouping comparison. From FY05-09, 34.8% of those contracted were reported as education code “12,” which was comparable to 36.0% for years FY15-17. Results are shown in Figure 37.

FY05-FY09 vs FY10-FY14		FY10-FY14 vs FY15-FY17		FY05-FY09 vs FY15-FY17	
Education Code for x	12	Education Code for x	12	Education Code for x	12
x1	262	x1	211	x1	262
n1	754	n1	553	n1	754
x2	211	x2	127	x2	127
n2	553	n2	353	n2	353
p1	0.3475	p1	0.3816	p1	0.3475
p2	0.3816	p2	0.3598	p2	0.3598
p	0.3619	p	0.3731	p	0.3514
z statistic	-1.2665	z statistic	0.6611	z statistic	-0.3993
p-value	1.7889E-01	p-value	3.2063E-01	p-value	3.6838E-01
p-value probability	17.89%	p-value probability	32.06%	p-value probability	36.84%
Little to no evidence		Little to no evidence		Little to no evidence	
Fail to reject null hypothesis		Fail to reject null hypothesis		Fail to reject null hypothesis	

Note: Data derived from Marine Corps Recruiting Command (2019, December 31).

Figure 37. Model output for Hypothesis 2b.

c. Model Output for Hypothesis 3b

There was strong evidence to support rejection of the null hypothesis for every year grouping tested. While the test for education code “12” for the ECC variable showed little to no evidence to support change in proportions over time, bear in mind that the test for Hypothesis 3b was testing the ECS variable and includes those who originally contracted as seniors but shipped as high school graduates. From FY05-09, 89.3% of those contracted as a MEOP had been either high school seniors or high school graduates without validated college credits. In FY15-19, this had dropped to 61.3%. Results are shown in Figure 38.

FY05-FY09 vs FY10-FY14		FY10-FY14 vs FY15-FY19		FY05-FY09 vs FY15-FY19	
Education Code for x	<= 12	Education Code for x	<= 12	Education Code for x	<= 12
x1	673	x1	416	x1	673
n1	754	n1	553	n1	754
x2	416	x2	363	x2	363
n2	553	n2	592	n2	592
p1	0.8926	p1	0.7523	p1	0.8926
p2	0.7523	p2	0.6132	p2	0.6132
p	0.8332	p	0.6803	p	0.7697
z statistic	6.7226	z statistic	5.0431	z statistic	12.0846
p-value	6.1258E-11	p-value	1.1975E-06	p-value	7.7539E-33
p-value probability	<1.00%	p-value probability	<1.00%	p-value probability	<1.00%
Overwhelming evidence		Overwhelming evidence		Overwhelming evidence	
Reject null hypothesis		Reject null hypothesis		Reject null hypothesis	

Note: Data derived from Marine Corps Recruiting Command (2019, December 31).

Figure 38. Model output for Hypothesis 3b.

d. Model Output for Hypothesis 4b

For education codes “13-15,” the model showed that there was strong evidence to support rejection of the null hypothesis when comparing FY05-09 to FY10-14, and when comparing FY10-14 to FY15-19. When comparing FY05-09 to FY15-19, there was overwhelming evidence to support rejection of the null hypothesis. From year groupings FY05-09 to FY15-19, the proportion of MEOPs shipped as education codes “13-15” more than doubled from 5.4% to 12.0%. Results are shown in Figure 39.

FY05-FY09 vs FY10-FY14		FY10-FY14 vs FY15-FY19		FY05-FY09 vs FY15-FY19	
Education Code for x	13 - 15	Education Code for x	13 - 15	Education Code for x	13 - 15
x1	41	x1	46	x1	41
n1	754	n1	553	n1	754
x2	46	x2	71	x2	71
n2	553	n2	592	n2	592
p1	0.0544	p1	0.0832	p1	0.0544
p2	0.0832	p2	0.1199	p2	0.1199
p	0.0666	p	0.1022	p	0.0832
z statistic	-2.0641	z statistic	-2.0516	z statistic	-4.3223
p-value	4.7398E-02	p-value	4.8633E-02	p-value	3.5005E-05
p-value probability	4.74%	p-value probability	4.86%	p-value probability	<1.00%
Strong evidence		Strong evidence		Overwhelming evidence	
Reject null hypothesis		Reject null hypothesis		Reject null hypothesis	

Note: Data derived from Marine Corps Recruiting Command (2019, December 31).

Figure 39. Model output for Hypothesis 4b.

e. Model Output for Hypothesis 5b

There was overwhelming evidence found to reject the null hypothesis for every year grouping comparison for education code “16.” From FY05-09 to FY10-14 the proportion more than tripled from 4.8% to 15.0%. From FY10-14 to FY15-19, it increased again from 15.0% to 23.0% of the overall MEOP population shipped to recruit training. Results are shown in Figure 40.

FY05-FY09 vs FY10-FY14		FY10-FY14 vs FY15-FY19		FY05-FY09 vs FY15-FY19	
Education Code for x	16	Education Code for x	16	Education Code for x	16
x1	36	x1	83	x1	36
n1	754	n1	553	n1	754
x2	83	x2	136	x2	136
n2	553	n2	592	n2	592
p1	0.0477	p1	0.1501	p1	0.0477
p2	0.1501	p2	0.2297	p2	0.2297
p	0.0910	p	0.1913	p	0.1278
z statistic	-6.3544	z statistic	-3.4239	z statistic	-9.9267
p-value	6.8075E-10	p-value	1.1356E-03	p-value	1.5972E-22
p-value probability	<1.00%	p-value probability	<1.00%	p-value probability	<1.00%
Overwhelming evidence		Overwhelming evidence		Overwhelming evidence	
Reject null hypothesis		Reject null hypothesis		Reject null hypothesis	

Note: Data derived from Marine Corps Recruiting Command (2019, December 31).

Figure 40. Model output for Hypothesis 5b.

f. Model Output for Hypothesis 6

The model's output showed that between year groupings FY05-FY09 and FY10-14 there was weak evidence to support rejection of the null hypothesis. There was strong evidence to reject the null hypothesis between year groupings FY10-14 and FY15-19. When comparing year groupings FY05-09 to FY15-19, there was overwhelming evidence to support rejecting the null hypothesis. While the rate of occurrences for all year groupings is relatively low, readers should note that there were more occurrences of education code "17-19" in the year grouping FY15-19 than there had been in the previous ten years by a factor of 11:6. Results are shown in Figure 41.

FY05-FY09 vs FY10-FY14		FY10-FY14 vs FY15-FY19		FY05-FY09 vs FY15-FY19	
Education Code for x	17 - 19	Education Code for x	17 - 19	Education Code for x	17 - 19
x1	4	x1	8	x1	4
n1	754	n1	553	n1	754
x2	8	x2	22	x2	22
n2	553	n2	592	n2	592
p1	0.0053	p1	0.0145	p1	0.0053
p2	0.0145	p2	0.0372	p2	0.0372
p	0.0092	p	0.0262	p	0.0193
z statistic	-1.7156	z statistic	-2.4025	z statistic	-4.2150
p-value	9.1569E-02	p-value	2.2259E-02	p-value	5.5328E-05
p-value probability	9.16%	p-value probability	2.23%	p-value probability	<1.00%
Weak evidence		Strong evidence		Overwhelming evidence	
Fail to reject null hypothesis		Reject null hypothesis		Reject null hypothesis	

Note: Data derived from Marine Corps Recruiting Command (2019, December 31).

Figure 41. Model output for Hypothesis 6.

G. MARKET PENETRATION AND RECRUITING PRACTICE COMPARISONS TO OTHER ARMED SERVICES

During the course of this research representatives of the Army, Navy, and Air Force were contacted in order to solicit non-personally identifiable aggregated data about the demographic qualities of their respective band programs. Areas of interest were size of their active duty non-premier bands, as well as gender, age, and education compositions. The research team also asked for non-opinionated amplification and clarification of their recruiting practices for their band programs that were not apparent from open-source references, such as what their primary education market is and whether

or not their service's recruiting commands were responsible for filling field band vacancies. Responses were received from the Senior Army Band Recruiting Liaison for the U.S. Army Recruiting Command (USAREC), the Superintendent for the Air Force Bands Division, and the Navy's Director of Fleet Band Activities.

The purpose of requesting this information was to make comparisons to any notable trends identified in the MEOP population. Open-source information about each service's recruiting practices, policies, and incentives for musician recruitment were also investigated. Given the identification of a definitive shift toward those with some level of college education, it is incumbent upon MCRC to understand how the other services are maneuvering in this market. While the information received from the service band representatives was informal data that should not be considered to be definitive or derived in a manner equitable to the techniques conducted in this research, it does provide an interesting insight for comparative purposes.

1. Army

The United States Army equivalent of the Marine's musician MOS is Army job code 42R (Musician) (United States Army [USA], n.d.). The Army's active duty regional bands are comprised of these soldiers and are the equivalent to the Marine Corps' field band U2 PEF. The Army also has four Army Special Bands, 12 Army Reserve bands, and 52 Army National Guard bands (D. Newcomb, email to author, October 3, 2019).

The Army lists a starting paygrade of E-4 for band members as well as a Student Loan Repayment Program (SLRP) for "select instruments" (United States Army [USA], n.d.-a, U.S. Army band benefits). The Army band's website section on eligibility lists the "preferred education/experience" as 10 or more years of experience, a bachelor's degree in music performance or education, and professional performance experience (United States Army Band [USAB], n.d., Eligibility). Applicants are required to achieve a score of at least 31 AFQT on the ASVAB. While the website stated that these preferences are not requirements, it also stated that those with such experience "are the most desirable and successful candidates for our positions" (USAB, n.d., Eligibility). This aligns with a 2016 Army Music Program pamphlet obtained from the Salinas, CA recruiting center in

August of 2019 that stated, “The talent pool is much higher and the difficulty of performed material is more aligned to musicians with greater experience and college education” (United States Army Recruiting Command [USAREC], 2016). The pamphlet directly marketed the Army’s “great opportunities” those who had completed their degree or were working musicians (USAREC, 2016).

To better understand the demographics of the U.S. Army active duty regional bands, the authors contacted Army Master Sergeant (MSG) David Newcomb, the Senior Army Band Recruiting Liaison for USAREC. On October 3, 2019, MSG Newcomb responded that the Army’s 20 active duty regional bands are comprised of 868 ensemble members. MSG Newcomb also provided an aggregate data table for new Regular Army enlistments into MOS 42R in FY18 and FY19, reproduced in Table 21.

Table 21. Regular Army band enlistments FY18-19. Adapted from e-mail communication with MSG Newcomb (October 3, 2019).

	FY19	FY18
<i>Basic Demographics</i>		
Avg Age	25.1	N/A
Male %	76%	83%
Female %	24%	17%
Avg AFQT	80.9	80.9
Avg Ed. Years	16.2	16
<i>Highest Degree Completed</i>		
High School Diploma	5%	9%
Some College	13%	18%
Associate degree	0%	3%
Bachelor’s Degree	56%	54%
Master’s Degree	24%	26%
Doctorate	3%	0%
Bachelor’s or higher	83%	80%

MSG Newcomb stated that USAREC is responsible for filling vacancies in the active duty regular bands and that their target market is “current and graduated college music students and working musicians.” He wrote that while their prospecting targets

colleges and professional music conferences, they do occasionally canvas high school students “such as when we exhibit at large state music educator conferences.”

2. Air Force

The United States Air Force equivalent to the Marine Corps’ field bands are the Air Force regional bands, which are comprised of ten regional bands (United States Air Force [USAF], 2019). The USAF bands webpage stated that “although most Air Force band musicians have earned undergraduate degrees, a college degree is not required to qualify” (Air Force Bands, n.d., Regional band FAQ). The minimum AFQT score for a regional band member is 31 (Military.com, n.d.). Upon completion of basic training, Air Force regional band enlistees are awarded a pay grade of E-3 (Air Force Bands, n.d.). Unlike the Army and the Marine Corps, the Air Force does not task their recruiting commands with filling band vacancies. According to the Superintendent for the Air Force Bands Division:

The Air Force Bands does all of its own recruiting. We look at our vacancies, taking into account retirements and PCSs and then advertise for open positions. We then fill vacancies with qualified musicians with a live audition, and they go to an Air Force recruiter to begin the enlistment process (M. Hornbuckle, email to author, October 3, 2019).

On September 20, 2019, SMSgt Hornbuckle wrote that the Air Force active duty regional bands have 401 allocations. Of these allocated slots, his most current report only accounted for 365 current members. Of these, 72.6% currently have a bachelor’s degree or higher (an unspecified number of individual educational level were “unverified”) and only 3.6% reported having a high school diploma as their highest level of education. Since the information was given for current band members instead of historical recruiting data, these figures may not reflect their education levels at time of enlistment. It also appears that the Air Force is willing to tolerate vacancies in their active duty regional bands.

3. Navy

The Navy’s musical equivalent to the Marine Corps’ field bands are its nine active duty regional fleet and command bands (United States Navy Band [USNB], n.d.).

In an October 23, 2019, email correspondence with the Director of Naval Fleet Band Activities, Commander (CDR) Robert Wrenn stated that the total enlisted authorization for the fleet and command bands was 372 members, with another 41 filling positions at the School of Music, Center for Service Support, recruiting, and recruit training.

Similar to the band talks conducted by Marine recruiters, the Navy Recruiting Manual instructs recruiters to give band presentations in their high schools (Navy Recruiting Command [NRC] 2016). Recruiters are instructed to meet with school band directors each school year in order to “promote the Navy Musician Enlistment Option, band talks, and auditioning for Navy Band” (NRC, 2016, p. 98). Like the Army and the Air Force, the U.S. Navy Band’s website stated, “the majority of our successful applicants have a college degree” (USNB, n.d., Fleet band activities). A 2013 online Navy article about recruiting for musicians stated “The vast majority of Navy musicians have earned a bachelor’s degree or higher in music before auditioning. This is important for young musicians and high school graduates to know so they are fully aware of the level of talent they are up against” (Langford, 2013). The AFQT requirement to qualify as a Navy musician was aligned with the overall service minimum of 35 (NRC, 2016). The Navy Recruiting Manual states that “Applicants cannot enlist or reenlist for the [musician] rating without prior approval of Director, Fleet Band Activities. Due to fluctuating [instrument] accession requirements, initial contact with the [musician rating] Detailer or [musician rating] audition supervisor at Fleet Band Activities is essential” (NRC, 2016, p. 480).

Those who enlist into a position in the Navy fleet bands are given the grade of E-3 (USNB, n.d.-a). The Navy Band’s website also suggested that prospective applicants to contact the Navy’s music auditions office about receiving up to \$65,000 in student debt relief (USNB, n.d.-a). For a perspective of how the Navy incentivizes musicians to enlist compared to other ratings, as of 2019 student debt relief was being offered to those enlisting under a musician’s rating along with 21 other ratings such as the nuclear field, advanced electronics, missile technicians, special warfare, explosive ordnance, and cryptology (United States Navy, n.d.).

In an email dated October 23, 2019, CDR Wrenn wrote that Navy Recruiting does not actively prospect for band members but will contact his office if they get an inquiry from a prospective applicant. CDR Wrenn also wrote that “although there are occasional high school applicants that may qualify, we target college and professional musicians through instrument specific open call auditions.” The Director noted that over the previous year, 97% of their 46 hires held a bachelor’s degree at time of enlistment while 47% of bachelor’s degree holders also held a master’s degree.

4. Overall Comparison to other Services

Based on the literature available about other service bands and the information provided by each service, it appears that the Marine Corps is unique in that is the only service that enforces an ASVAB AFQT score higher than the service minimum for its musicians. The Marine Corps also appears to place the greatest amount of emphasis on generating musicians from the high school senior and recent high school graduate market and is the only service whose website did not explicitly state that most of its successful applicants hold a bachelor’s degree at time of enlistment. While each service offers some form of promotion benefit or shipping bonus, only the Navy and Army offer college loan repayment options for musicians. When comparing the quality of musical talent of the Marine Corps field bands against other service equivalents, it is important to keep in mind that the Navy, Air Force, and Army are almost exclusively contracting musicians who have at least a bachelor’s degree, while the results of this study showed that in FY19 only 43.7% of USMC U2 shippers had at least one year of verified college education.

H. SUMMARY OF EXCEL MODEL RESULTS

This study’s findings support the rejection of all null hypotheses except for Hypothesis 2a, Hypothesis 2b, and the portion of Hypothesis 6 that compared ECS codes “17-19” from FY05-09 to FY10-14. There was evidence to suggest a significant decrease in the proportion of those contracted at education code “11” and a significant increase in the proportion of those shipped as education codes “13-15” and “16.” Those contracted as education codes “12” at contracting demonstrated relative stability over time. While this research did not construct a hypothesis to the grouping of education codes “13-19,” it did

apply a z-test model to demonstrate the significance of proportional increase of the college education that may not be as apparent when the education codes are evaluated piecemeal. From FY05-09 the proportion of codes “13-19” was 10.7%. From FY10-14 it was 24.8%. By FY15-19, it rose to 38.9%. Results of this model’s output is shown in Figure 42.

FY05-FY09 vs FY10-FY14		FY10-FY14 vs FY15-FY19		FY05-FY09 vs FY15-FY19	
Education Code for x	13-19	Education Code for x	13 - 19	Education Code for x	13 - 19
x1	81	x1	137	x1	81
n1	754	n1	553	n1	754
x2	137	x2	229	x2	229
n2	553	n2	592	n2	592
p1	0.1074	p1	0.2477	p1	0.1074
p2	0.2477	p2	0.3868	p2	0.3868
p	0.1668	p	0.3197	p	0.2303
z statistic	-6.7226	z statistic	-5.0431	z statistic	-12.0846
p-value	6.1258E-11	p-value	1.1975E-06	p-value	7.7539E-33
p-value probability	<1.00%	p-value probability	<1.00%	p-value probability	<1.00%
Overwhelming evidence		Overwhelming evidence		Overwhelming evidence	
Reject null hypothesis		Reject null hypothesis		Reject null hypothesis	

Note: Data derived from Marine Corps Recruiting Command (2019, December 31).

Figure 42. Model output for z-test of education code grouping “13-19.”

V. CONCLUSIONS AND RECOMMENDATIONS

A. TEST RESULT INTERPRETATIONS

While this research identified several statistically significant changes in education code proportions over time, these changes may also be considered operationally significant because it implores the recruiting force leadership to evaluate current MEOP policies, recruiting strategies, and marketing tactics. In terms used by the Marine Corps Communication and Consulting (MC3) process, the “needs and motivators” of a recent college graduate are likely much different than the high school senior (MCRC, 2011). The years of experience separating the two cohorts create dissimilar circumstances, feelings, and life goals that force the recruiter to identify different “priority needs,” which are “needs powerful enough to drive action” (MCRC, 2011). Furthermore, the shift into the college markets and the clustering of qualified musical talent in certain regions and band programs may not align with current MEOP missioning policies. This section expounds on the findings discussed in Chapter IV, postulates causal factors, suggests potential courses of action, and provides recommendations for future research.

1. High School Seniors

There has been a clear shift in the proportion of MEOP poolees who contracted during their senior year of high school. In FY05, 64.1% of all U2 PEF shippers were contracted during their senior year of high school. This proportion is generally equitable to the overall accepted proportions for the total enlisted market, with RSs normally aiming to contract at least 50% of their monthly contracting mission as high school seniors and the other 50% high school graduates. By FY17, the proportion of MEOPs contracted as high school seniors declined to 27.0%, representing the most dramatic shift of all of the education codes analyzed in this study. FY15 and FY16 saw even lower proportions of high school seniors at 24.2% and 22.8%, respectively. The research team has no reason to suspect that the years since FY17 are dramatically different than the most recent years, but were unable to validate this assumption due to unreliable data for the “Education Code at Contract” variable for education code “11” in FY18 and FY19.

2. High School Graduates

Of those who were high school graduates without at least one year of verified college credit were the only education code analyzed that did not have a statistically significant shift in proportions over time. While there was a significant decrease in high school seniors and a significant increase in those with college experience, the proportion of high school graduates was relatively static. It appears as if there are more high school seniors who transition into high school graduates before enlisting as musicians, and more high school graduates who enlist after at least some college education, leaving the “bucket” of seniors at a relatively constant volume. The combined proportion of those contracted as either a high school senior or high school graduate decreased from 89.3% from FY05-09 to 61.3% from FY15-19, suggesting that this decrease in proportion is due to the overall decrease in those contracted as high school seniors and not a change in the proportion contracted as high school graduates.

This study could not quantitatively analyze the relationship between audition scores and audition passage rates in comparison to other enlistment variables. However, it may be the case that high school seniors are showing an increasing rate of requiring multiple auditions before receiving a qualifying score (if they ever receive a qualifying score), and are thus not contracting until they’ve already graduated high school. If that is the case, there is a risk that those who are on the cusp of a qualifying may become frustrated with the repeated failures and pursue other career opportunities – such as attending college or enlisting into a different MOS. This hypothesis would require its own formal analysis to verify and was beyond the scope of what the research team was able to explore with the available datasets. However, this hypothesis appears at least plausible when evaluating the MEOP issue holistically.

3. Undergraduate Experience, Bachelor’s Degrees, and Advanced Degrees

Between FY15-19, those shipped with at least one year of college education accounted for 38.7% of the MEOP population, compared to 10.7% between years FY05-09. While there was a statistically significant increase in those shipped as education codes

“13-15” over time, this subset of the MEOP population is still comparatively small. From FY05-09 to FY15-19, the proportion for codes “13-15” increased from 5.4% to 12.0%. On the other hand, the growth in those who shipped as education code “16” (four years of undergraduate studies) increased from 4.8% in years FY05-09 to 23% in years FY15-19. To put that into perspective keep in mind that Table 2 shows that in the year 2017, only 2.61% of the entire Marine Corps active duty enlisted population was reported to have a bachelor’s degree, nearly a ninefold difference in proportion compared to the MEOP population (ODASD MC&FP, 2017). Bear in mind that the data shown in Table 2 also accounts for Marines who earned their bachelor’s degree while serving on active duty, while the dataset used for this thesis represents education obtained prior to ascension to active duty. Thus, the true disparity may be larger than this comparison is able to show.

The disproportionate growth of those who have completed four years of undergraduate studies compared to those with one to three years of college credit may be due to those prospecting college musicians encouraging the students to finish their degrees before enlisting. In an email dated April 28, 2020, MSgt Stanley wrote that the MTAs generally encourage college students to finish their degrees before enlisting, because encouraging them to enlist prior to graduation may not be in the students’ best interest and can also damage the recruiting forces’ relationship with the university.

This research also identified a statistically significant increase in those who have advanced degrees at time of shipping (education codes “17-19”), but this cohort still represents a small proportion of the overall MEOP population. While this demographic represents the smallest grouped demographic studied, it is worth noting that the proportion of advanced degree holders increased from 0.5% in years FY05-09 to 3.7% in years FY15-19. There was weak evidence to suggest a change in proportion for codes “17-19” between FY05-09 and FY10-14, strong evidence found when comparing FY10-14 to FY15-19, and overwhelming evidence found when comparing FY05-09 to FY15-19.

B. CAUSAL FACTORS

This study sought to answer the question of whether or not there has been a statistically significant shift in the MEOP market, and to that end it identified strong evidence to suggest that there has been such a change. The research team did not attempt to answer the qualitative question of *why* that shift has occurred, but over the course of their research it was natural to mentally hypothesize causal factors. A rigorous qualitative research effort would be required to definitively address any postulated causal factors for these trends, but the research team has provided their perspectives for consideration to the Marine Corps and any future research efforts that may take place.

1. Effect of Changes Implemented after the 2015 MEOP Operational Planning Team

The trends identified for education code proportions were already taking place before the 2015 OPT, and have continued since the post-OPT changes were implemented. That is not to say the changes made after the OPT did not have any effect, but it is to say that they appear not to have reversed, slowed, or accelerated these trends. It may be prudent for MCRC to consider convening another OPT to consider additional changes to MEOP recruiting practices. Given the statistically significant shift in quinquennial year groupings in nearly every education code category except high school graduates, the MEOP program may benefit from formal revaluation at least every five years.

2. Audition Standards and the Quality of High School Music Programs

Those at the tip of the spear in the recruiting force may feel that the trend toward those with college experience is partially related to musical audition standards becoming more difficult. With this in mind, the student researcher asked the MCRC MEOP SME if there had been any appreciable changes to audition standards over time. In an email dated December 19, 2019, MSgt Stanley stated, “there have been no major changes to the audition requirement standards since the inception of the MTA program in 1993,” and that only minor changes have been made to audition requirements that should not have had a significant impact on difficulty. While it appears that audition standards have not appreciably changed based on MSgt Stanley’s response, adherence to those standards

may have become more strictly and consistently adhered to over time to ensure quality and consistency. It is also possible that as evaluators have been exposed to higher caliber auditions over time, and that there has been an unofficial increase in the expectations for auditioners. Even if standards have not become formally more difficult *de jure*, there may have been an unconscious *de facto* increase in audition standards over time.

These hypotheticals would be consistent with the efforts MCRC has invested in training their MTAs and the audition quality control measures put in place over the last several years. It is also possible that in previous years when MEOP missions were higher and the overall recruiting force was stressed by the accession requirements demanded by wartime operations, that there was an increased pressure to pass marginally performing musicians in order to meet annual musician quotas. Sacrificing quality for quantity is unfortunately a side effect of recruiting under difficult circumstances that involve high mission quotas. In the current operating environment that enjoys comparatively lower accession requirements, those screening musical auditions who were formerly “beggars” may now enjoy the luxury of being “choosers.”

It is also possible that the overall quality of musical abilities at the nation’s high schools have decreased over time while Marine Corps Music Program standards have remained constant, leading to less and less high school musicians being able to qualify. The unsolicited opinion of this study’s MEOP SME POC was that the quality of high school music programs has dramatically decreased over the last two decades, while musically proficient high school students have more options beyond a music career in the Marine Corps. This may have also had a hand in driving down the proportion of high school seniors enlisting as musicians.

Hypothesizing that adherence to audition standards have become more stringent and that the quality of high school musicians has degraded over time are not mutually exclusive possibilities, and may have been occurring at the same time to some degree. The research team lacked the professional expertise to judge either scenario; these are questions more appropriately answered by Marine Musicians and Career Recruiters who possess the tacit knowledge required to give appropriately informed responses.

3. Multivariate Explanation for Market Shift

Instead of pointing to a single culprit as the cause for a shift in education proportions, a combination of increased scrutiny for auditions standards, a general decrease in the musical proficiency of high school musicians, the effectiveness of MTAs and recruiters in penetrating the college and professional markets, and a decrease in the number of working high schools over time may all be contributing factors. There may also be factors involved that the research team failed to imagine and account for.

Although there may be several reasons for the shift, not all presumptions are equally likely. In the student author's experience, the phrase "more kids are going to college instead of enlisting after high school" was an often-heard observation, usually from a struggling RSS in a relatively affluent area where college attendance rates were traditionally high. While it may be tempting to postulate that a shift in demographics away from high schools and toward colleges is also related to higher rates of college enrollment over time, keep in mind that national college enrollment rates between 2000, 2010, and 2017 were not "measurably different" from one another (NCES, 2019, p. 146). Increased rates of college attendance appear to have been a generational shift over the last several decades, not a recent phenomenon that would explain such sharp shifts in MEOP proportions over the last 15 years.

If a Recruiting Station could make their MEOP mission solely by prospecting the high school market, they likely would. RS XOs and enlisted recruiters focus much of their attention on their high schools through the High School and Community College Program, and may only be penetrating the college market for MEOP contracts out of necessity. It may also be true that Recruiting Stations are contracting more and more college-educated individuals because they recognize that greatest concentration of qualifying talent is in university music programs. A Recruiting Station may find several musically qualified individuals in a single university's music program, while the same volume of qualified talent at the high school level may be dispersed over thousands of square miles within the RS's area of operations. Imagine wandering a dry desert in search for water. Do you keep digging holes in the sand in search for a drink, or do you seek out the oasis watering hole? Furthermore, once a RS or MCD has made positive inroads

within a college music program, such a relationship may produce qualified prospects for years to come. Those university programs can become a well that thirsty Recruiting Stations may draw from annually, while the university music programs perform the task of distilling regional musical aptitude into these concentrated pools of talent.

C. POTENTIAL COURSES OF ACTION

If there continues to be a shift toward the college market or if remains approximately at its current proportions, MCRC risks competing for market share in a venue that is not traditionally the focus of its enlisted recruiting efforts and away from its traditional center of gravity within the high school market. The Army, Navy, and Air Force almost exclusively focus their musician recruiting efforts on the college and professional markets. Given this, a continued shift in this direction for the Marine Corps may mean elbowing for market share with services who may be outgunning MCRC in terms of manpower, marketing resources, and enlistment incentives. While this may not pose a risk to mission attainment in an era of low MEOP missions or economic downturns where the number of qualified collegiate musicians greatly outnumber the number of available positions within the military , it may create future hardships as circumstances change over time, and at best represents an organizational strategy misalignment.

This presents the Marine Corps with a few general courses of action to consider in order to ensure that the Marine Corps Music Program continues to receive adequately qualified musicians into its ranks while enabling MCRC to achieve its mission in the most efficient and effective manner possible. These options can be thought of in terms of paddling a canoe in a river with a strong current. The choices are to go with the flow and let the current take you where it may, to paddle against the current and attempt to reverse course, or to paddle with the current and get where it is taking you even faster.

- (1) COA 1: Accept the continued trend toward the college market without changes in recruiting strategy and methodology.

The Marine Corps may acknowledge that there has been a trend toward the college market over time while choosing to not alter current recruiting practices as long

as the recruiting force continues to meet annual mission requirements. This may not be the most effective or efficient approach to MEOP recruitment, and may place undue burden on the recruiting services who must carefully allocate their time and energy resources. As discussed in Chapter I, the current structure for recruiting U2 PEF musicians may also cause unnecessary friction for RSs, MCDs, and prospective applicants who are vying for instrument allocations that are distributed to each District.

The research team does not recommend doing nothing, but it does recognize that if nothing is done education proportions have the potential to stabilize without any changes being made to recruiting practices. It is unlikely that the proportion of high school seniors will continue to erode at the same rate as they have over the last 15 years, but is possible that the proportion of ECC code “12” may begin to decline if more and more college-educated individuals are contracted over time. Imagine the decline in high school seniors resembling a logarithmic decay curve that is approaching an unknown limit on the y-axis as time moves forward along the x-axis.

If no actions are taken, the Marine Corps should at least closely monitor education proportions moving forward. If MCRC perceives that the MEOP mission is being made by a comfortable margin without undue stress on the recruiting force, if the Naval School of Music and Marine Corps Music Program are content with the level of talent they are receiving, and if Marine Corps Manpower is not struggling to retain the required number musicians after their first enlistment, then accepting the status quo may be a viable option under the current operating conditions. If the *status quo* is the COA of choice, it is recommended that contingencies be planned should future circumstances dictate a change.

(2) COA 2: Attempt to reverse the trend toward the college market.

If the Marine Corps believes that the shift in education proportions has become too heavily weighted toward college-educated individuals and threatens the ability to achieve mission under their current recruiting structure, then it may decide to attempt and reverse the trend and reorient toward high school seniors and recent high school graduates. MCRC is already achieving high completion rates for high school band talks and is allocating some of its MEOP advertising resources toward high school students.

Additionally, the reforms implemented after the 2015 MEOP OPT have already refined the focus of RS Command Groups on MEOP mission attainment (MCRC, 2015). By making the RS XO the MEOP program manager, MCRC implicitly tucked the MEOP program under the wing of the HSCCP, similar to the NROTC Scholarship Program. MCRC also faces external factors beyond its influence that may be pushing recruiters into the college market, such as the hypothesized decline in overall high school music program quality.

Given these circumstances, it is difficult to imagine how the enlisted recruiting force could reverse the trends identified in this research – paddling against the current may only slow the velocity of the canoe toward the college market instead of reversing course, while exhausting the arms of those doing the paddling. If the Marine Corps decides that rebalancing MEOP contracting toward the high school market is its goal, it would likely require addressing current musical audition standards. While this would certainly benefit MCRC’s ability to contract MEOP applicants in high schools, it may also produce a population whose musical abilities are inferior to the needs of the Marine Corps. It is difficult to imagine a scenario where the Marine Corps decides to lower its standards for applicants in order to make mission attainment an easier task, especially if missions are being made. It is often the case that dramatic change is only precipitated by dramatic failure with causes that were either unforeseen or discounted.

As difficult as it may be to imagine, if MCRC is able to devise a way to shift education proportions back to historical averages, it will benefit by having an almost exclusive market share for musicians in the high school market. The responses received from other service representatives demonstrates that high school musicians are an afterthought in terms of prospecting. If the Marine Corps is able to adjust their aim for windage and bring their impact area back toward the high school senior market, it is unlikely that these musicians will be aggressively scouted by other recruiting services.

(3) COA 3: Embrace the shift toward college market.

As previously stated, the shift toward the college market may be due to Recruiting Stations recognizing where the greatest concentrations of musical talent are, being

university music programs. The benefit of choosing to embrace the shift toward collegiate-level musical talent is that it is a decision to paddle with the current instead of against it, an inherently easier task. The downside of this COA is that recruiting for field band musicians is an enlisted recruiting operation, while MCRC's aimpoint for enlisted recruiting is the high school senior and recent graduate market. Embracing the shift toward the college market for musicians highlights some vulnerabilities in MCRC's current recruiting tactics, techniques, and procedures.

Enlisted recruiters are pressured to meet the annual milestones established for the High School/Community College Program, not to actively prospect on university campuses. When a Recruiting Station is in danger of missing its MEOP mission, a natural reaction for the Command Group may be to turn the screws on the enlisted recruiting force, but the enlisted recruiting force's attention is typically on high school seniors and noncollegiate high school graduates. Sending an enlisted recruiter to "head hunt" on a college campus can be a risky endeavor, tasking the OSO to provide MEOP referrals falls outside their current mission set, and relying on the MTA and XO to become the main effort for prospecting collegiate talent creates a bottleneck effect that risks creating a single point of failure by narrowly channeling prospecting efforts into a handful of already task-saturated individuals.

This study has demonstrated that the investment of resources into the high school market for MEOP contracts has had a declining return on investment over the last 15 years. A person with leadership experience at the Recruiting Station level will likely tell you that when there is a perceived danger of missing MEOP mission late in a fiscal year, most other concerns fall by the wayside as a frantic prospecting effort ensues for a musically, mentally, physically qualified, and ready-and-willing-to-ship player of an uncommon instrument (a category of applicant often referred to as a "unicorn," a mythical creature one is not likely to find outside of dreams or fantasy). While MCRC is making its current missions for musicians, that does not mean there is not an organizational misalignment in how that mission is attained.

Reorienting prospecting efforts toward college music programs will likely require several changes to recruiting practices, marketing efforts, and applicant incentives. These

changes can likely be made while preserving the exposure high school students receive from the band talks enlisted recruiters deliver in working high schools, and while RS XOs continue to exert pressure in order to generate MEOP screening forms from other recruiting activities within their area of operations.

The risk associated with this COA is that MCRC will find itself competing in a market where all other service bands are already focusing the preponderance of their prospecting efforts. Like always, this will require the Marine Corps to demonstrate to prospective applicants the value of the Marine Corps' intangible qualities – the “abstract features thought to be somewhat unique to the Marine Corps” (MCRC, 2014a, p. 10-2). The Marine Corps is unlikely to win the battle of the checkbook in terms of offering financial incentives compared to other services, but tailoring certain financial benefits toward the college market could be an arrow in the quiver of the recruiter trying to gain the commitment of a collegiate musician.

A typical Recruiting Station may have an annual shipping mission of 500–700 poolees per fiscal year, with perhaps three of these being MEOP contracts. While finding three musicians a year does not sound like a tall order, someone who has served on recruiting duty at the Recruiting Station level would likely insist otherwise. If the Marine Corps chooses to embrace the shift toward the college market and appropriately restructures MEOP prospecting to achieve optimal efficiency and effectiveness, there are several actions that may be taken while preserving the focus of recruiting efforts for the other ~99.5% of the non-MEOP mission where it belongs, which is in the high school and recent high school graduate markets. Several suggestions that may help achieve this COA can be found in the recommendations section of this chapter.

D. RECOMMENDATIONS

- (1) Explore the feasibility of a College Loan Repayment Program (CLRP) for highly qualified applicants.

One of the life circumstances most college-educated individuals have that high school seniors and recent high school graduates do not are large sums of student loan debt. In 2019, NCES reported that the average cumulative loan debt for undergraduate

degree holders who received loans was \$28,000 for public institutions, \$33,200 for private nonprofit, and \$43,000 for private for-profit schools (NCES, 2019). This fact along with how other military services attract collegiate musicians should be kept in mind when evaluating the “financial security” “benefit tag” for MEOP applicants (MCRC, 2014a, p. 10-2). A \$6,000 enlistment bonus for the U2 PEF and a junior enlisted paygrade may have less appeal to the 23-year old college graduate with significant loan debt than it does the 17-year old high school senior with no significant debts.

A program that alleviates MEOP Marines of a portion of their college debt may be a useful tool in attracting college-educated applicants or retaining musicians after their first enlistment expires. Such a program could be tied to a longer initial contract length or may be offered as a First Term Alignment Program (FTAP) incentive to retain musicians who have already proven their musical capabilities and who are also holistically excellent Marines. The Navy already operates a CLRP program for musicians and other ratings; it may be worth investigating to see if a similar program is feasible for MEOP recruiting or any other community that requires preexisting special KSAs - such as the newly formed cyber warfare community of MOSs.

- (2) Explore the feasibility of a tiered enlistment bonus system for MEOP applicants based on audition score and consider inflation-adjusted enlistment bonuses.

While throwing money at the problem of recruiting is a suggestion that is restricted by budget constraints, monetary bonuses are a tool that the Marine Corps has traditionally used to fill certain military occupational specialties. This study has shown that college educated musicians have a greater propensity to achieve an audition score that qualifies them for an “advanced” qualification status. An additional incentive that rewards demonstrated capabilities could be to tier U2 enlistment bonus amounts based on audition performance. As long as MTAs and the School of Music maintain quality control standards for auditions to prevent abuse of this incentive, providing a higher enlistment bonus for highly qualified applicants could assist the recruiting force in gaining the commitment of college applicants with advanced musical abilities.

In 2008, Ramsey B. noted that the monetary incentives offered in Enlisted Bonus Programs have generally remained unchanged over the last several years, and that this stagnation may lead to a decrease in effectiveness. For instance, the Marine Corps Enlistment Incentive Program bonus for the U2 PEF was \$7,500 in FY11 and FY12 and has been \$6,000 every year from FY13-FY20 (M&RA, 2019) (M&RA, 2011) (M&RA, 2011a) (M&RA, 2012). To demonstrate the decreasing monetary value of these benefits, the research team applied an online consumer price index (CPI) calculator to enlistment bonuses. The \$6,000 bonus offered in October 2012 was worth \$6,654 in August 2019 after adjusting for CPI, yet the bonus offered in August 2019 for FY20 was \$6,000. The \$7,500 bonus offered in January 2011 would have been equitable to \$8,737 when the FY20 bonus amounts were announced (BLS, n.d.). Although year-to-year effects of inflation may not have a dramatic impact on incentive outcomes, it still may be worth evaluating for future bonuses offered by the Marine Corps.

- (3) Reallocate MEOP marketing resources to be weighted more heavily toward the college market than the high school market.

Without knowing to what degree the MCRC's marketing weights resources between high school and college markets, this study recommends that these allocations be reevaluated to determine if they are appropriately distributed to achieve the greatest return on investment in the high school, recent high school graduate, and college-educated markets given the demonstrated shift in their enlistment proportions over time.

- (4) Create a tier system that categorizes each college band program based on size, quality, and enlistment propensity.

A three-tiered system similar to the one used for MCRC high school prioritization could help recruiting commands direct resources toward the most promising college band programs. An analysis to appropriately categorize college music programs could be completed by experienced leaders within the Marine Corps Music Program. A review of the 2015 MEOP OPT PowerPoint showed that there is already general awareness of which university music programs have strong reputations within the professional music community (MCRC, 2015).

The research team recommends considering a requirement for RS representatives to request an in-person presentation to certain university band programs. Recruiters already conduct band talks at some community colleges, and this information is already tracked in MCRISS. It is not difficult to imagine a future requirement to track university band talks as a component of MEOP recruiting efforts. It is suspected that this may already be occurring informally in some commands, but it ought to be codified into the ERP.

Under the envisioned three-tier system, the District MTA and seasoned recruiter could be tasked with requesting presentations at all Tier I band programs. An RS Command Group member, OST member, or SNCOIC and a recruiter could request a visit to Tier II programs and Tier I program not visited by the MTA. Finally, a seasoned recruiter or OST member could visit Tier III university programs. The research team suggests that recruiters sent to deliver band talks to a college audience be carefully chosen based on their performance as a recruiter, knowledge of the Marine Corps Music Program, professional demeanor, and personal maturity. A recruiter or Command Group member who is perceived to be “hustling” a university band program for a “quick sell” may damage the relationship being developed, potentially poisoning the well and leading to restricted access for both enlisted recruiters and the OST. OST personnel could also be incorporated into helping coordinate visitations and presentations, fulfilling a dual purpose of canvassing for officer candidates.

- (5) Create a “band talk” presentation appropriately tailored for presentation to collegiate music program audiences.

To enable recruiters and RS Command Groups to deliver a professional presentation that is appropriately tailored to a collegiate audience, MCRC should consider reviewing the current high school band talk presentation guidelines to see if there are any changes that could be made to specifically appeal to college band programs. What appeals to the high school student who participates in a band as an extracurricular activity and what appeals to the college student who chose music as their profession may be very different.

- (6) Codify the requirement for Officer Selection Officers to provide lists of musician listings to marketing and enlisted recruiting operations from Frost Call 025–15 into the next revision of the Guidebook for Officer Selection Officers and make it an inspectable annual task.

In 2015, Frost Call (FC) 025–15 directed that

“NLT 1 October 2015, Officer Selection Teams (OST) request musician listings from each university in order to enable MCRC Advertising (JWT) to execute targeted mass mail-outs to prospective MEOP applicants. These listings should be shared with enlisted recruiting to enhance prospecting efforts for college level musicians.” (MCRC, 2015a, p. 4)

While it is unclear if this directive was supposed to be an ongoing annual task, this research noted that the only mentions of the words “band,” “MEOP,” or “music” within the Guidebook for Officer Selection Officers is the passing reference of “consider other key individuals on campus such as those affiliated with the campus’ rec sports, the campus gym, ROTC units, the band (to provide contacts for enlisted recruiters), etc.” (MCRC, 2015b, p. 19-2). Additionally, the checklist for the annual OST Systematic Recruiting Inspection (SRI) does not appear to make this task an inspectable item, although it does ask if the OST tracks officer-to-enlisted and enlisted-to-officer referrals (MCRC, 2015b).

The research team recommends that the directive in Frost Call 025–15 be codified as a specific task in the next Guidebook for Officer Selection Officers rewrite, and that this it be an inspectable item during the annual SRI. Old directives may go unnoticed by new OSOs and unenforced by uninformed RS Command Groups. The adage “inspect what you expect” appears appropriate for this situation.

- (7) Create a tracking system for all MEOP enlistees that includes the key enlistment demographics captured by MCRISS, information about each individual audition scores, the number of times they formally auditioned, and performance metrics at the Naval School of Music.

This research would have greatly benefited from data regarding individually attributable musical performance statistics, which would have enabled it to evaluate relationships between its chosen variables beyond what it was able to achieve. It may be the case that non-aggregate data already exists in some form within MCRC or the Naval

School of Music, but it appears that this data may be compartmentalized and often non-standardized for use in conjunction with MCRISS queries. A representative who is specifically tasked with maintaining a long-term digital record of key demographic information from the enlistment process, pre-enlistment audition information (attempts and scores), NSOM performance metrics, and first enlistment outcomes would benefit future research efforts.

(8) Reevaluate the requirement to score at least 50 AFQT on the ASVAB.

Given that no other service appears to have an AFQT requirement beyond their overall service minimum for musician enlistment standards, the research team recommends that the necessity of the Marine Corps' requirement of a score of 50 AFQT be reevaluated. Table 14 shows that only 4.8% of the total U2 PEF population from FY05-19 enlisted with a score less than 50. Additionally, only 5.7% of those who shipped with an education code of "12" or less and 1.8% of those shipped with codes between "13-19" had scores below 50. While those who shipped as "12" or less represented 76.5% of the total population found in this study's dataset, this same cohort accounted for 91.2% of all AFQT scores under 50.

Those who fail to demonstrate an adequately high score on the ASVAB may be more likely to struggle with the academic requirements at the Naval School of Music, while most of scores under 50 came from those without college experience. The fact that no other service has an AFQT requirement for musicians may be nullified by the fact that their musician populations have high majorities of college-educated individuals that make sub-50 scores less likely, while the Marine Corps still enlists a (shrinking) majority from the high school senior and recent high school graduate markets.

Given this, MCRC should consider reevaluating the AFQT score requirement for those who have at least one semester of college credit and/or a minimally acceptable overall GPA. The AFQT requirement could also be waived by those with a minimally acceptable score on their Scholastic Aptitude Test or American College Test, not unlike the requirements for the NROTC Scholarship Program. AFQT score requirements could also be waived for those who performed at advanced levels on their musical audition,

since those individuals do not attend the BMC at NSOM and thus are not at risk for failing to meet academic standards. Such considerations seem to pose a minimal risk to quality control efforts.

- (9) Enable historical data in MCRISS to be viewed in a more linear time-series manner versus the current stove-piped data structure in order to enable easier trend analyses.

The research team recommends that the automatically generated reports in MCRISS be available in a less stove-piped and more linear fashion. The current method of viewing historic trends from data in the Commanders Attainment Report, the High School/Community College Progress Report, and Progress Analysis Report is tedious and time consuming. To view trends between fiscal/school years, an individual report must be generated for each year and for each echelon of command being analyzed. The data from each report must then be aggregated into a common file, most likely a Microsoft Excel document. The extracted data is either typed manually (a wearying task when analyzing 15 years of data from 90 separate High School Progress Reports) or done by developing an Excel macros tool that would automatically pull data from each imported report (a task that requires an above-average Excel skillset).

Creating a feature organic to MCRISS that would give the ability to view key statistics from such reports in a linear fashion spanning several individually described years would enable data analysts at every echelon of command to gain a greater insight on previously unrecognized trends occurring in their area of operations. As it stands now, analyzing the types of trends identified in the High School/Community College Progress Reports requires the kind of time and energy that a full-time graduate student at NPS has, but a task-saturated Marine on recruiting duty does not.

E. FUTURE RESEARCH

This research sought out to answer the broad questions initially outlined in Chapter I. During the research team's efforts to answer those questions, it naturally came upon other related questions that may be worth answering but were beyond this study's scope of research.

- (1) Is the MEOP recruiting model applicable to other low-density, high-value communities that require preexisting knowledge, skills, and abilities?

This particular question has been raised at some of the highest levels of Marine Corps leadership, specifically pertaining to the cyber warfare community. In 2017, the Marine Corps Deputy Commandant for Information stated, “Maybe there is an opportunity to look at other ways [of recruiting cyber forces], kind of the Marine Corps Band Model...” (Ramsey, B. 2020, p. 57). Although this statement was referring to the uniqueness of the President’s Own musicians (who are not recruited in the same manner as U2 or U4 PEFs), Marine musicians for the U2 and U4 PEFs are currently the only enlisted MOSs in MCRC that require a specifically tested skill prior to enlistment into that MOS. The nearest equivalent are those taking the Defense Language Aptitude Battery for certain enlisted MOSs, officer candidates who must pass the Aviation Selection Test Battery before obtaining an aviation-guaranteed contract, or Judge Advocate General applicants who must possess a law degree and pass the bar exam in their state before commissioning under a law contract.

It is not difficult to foresee a future requirement for some enlisting into the Marine Corps’ cyberspace operations occupational field to demonstrate some sort of preexisting proficiency before obtaining a “cyber contract.” The appropriateness of current recruiting models for the field bands, the Commandant’s Own, and President’s Own may be worth evaluating in order to develop the most appropriate recruiting model for future cyberspace operational needs.

- (2) Are musical audition and performance standards appropriately calibrated for the needs of the Marine Corps Music Program?

This question was already raised when this research presented its course of action recommendations. Lofty audition standards may provide field bands with high-quality talent, but it also may put undo strain on the enlisted recruiting forces under the current prospecting structure. Standards that are too low benefit may the recruiting efforts, but may also damage the reputation of excellence that the Marine Corps Music Program possesses. Identifying the “Goldilocks” of standards that are neither too stringent nor too lax would benefit all parties concerned.

- (3) Is the Marine Corps Recruiting Command appropriately aligned to prospect for those who qualify under current audition standards?

This study identified a significant shift toward the college-educated market for Marine musicians. It also found that all other recruiting services predominately focus their prospecting efforts in the college and professional musician market, and at least one service does not even task its recruiting force to fill field band vacancies. Given that MCRC enlisted recruiting operations is oriented toward the high school market and also tasks the enlisted recruiting force to meet annual quotas for field bands, MCRC may not be appropriately postured to comfortably achieve the MEOP mission in the future if it is necessary to recruit a significant portion of college-educated individuals to meet mission requirements.

- (4) Is the current “fair share” mission apportionment model the most appropriate method for allocating annual MEOP missions?

The current model of MEOP recruiting generally apportions the annual MEOP mission based on the “fair share” concept, which is in part based on the size of the Civilian Non-Institutionalized Population (CNIP) within a command’s area of operations. This model appears to be effective for the overall enlisted accessions mission but may not be appropriate for missions such as MEOP. The information provided by the 2015 MCRC MEOP OPT suggests that kind of talent required to qualify for a MEOP contract may not be evenly aligned with the distribution of the CNIP, and thus may not be apportioned based on where musical talent is most concentrated (MCRC, 2015).

Based on the 2015 MEOP OPT’s research efforts, it appears that the top collegiate music programs in the United States are generally found in the northeast corridor and the west coast, while certain states have reputations for much stronger high school music programs than other states (MCRC, 2015). If musical talent is not diffused throughout the general population evenly and is instead cloistered in certain regions, then a “fair share” apportionment may not be “fair” regarding the MEOP mission. This may in part explain why certain Recruiting Stations may perennially struggle to meet their annual MEOP mission while others seem to be flush with qualified applicants every year.

If this is the case, it may require a reevaluation of current MEOP missioning techniques to identify a more balanced model. Under the current recruiting structure, positions are filled in a first-come-first-serve basis, meaning that if a Recruiting Station contracts a marginally qualified applicant early in the year for a low-density instrument slot, the Recruiting Station who finds an exceptionally talented individual for the same instrument later in the year may still miss their MEOP mission. This outcome does not appear to be an equitable outcome for the Recruiting Stations and does not ensure that the Marine Corps Music Program is receiving the most qualified individuals.

Hypothetical alternative recruiting structures could involve removing the MEOP contracting requirement from the RS level and instead institute a quota for qualified applicant submissions, not unlike the NROTC scholarship program system. This quota could be assigned by estimating the musical propensity within a region based on professional guidance of MCRC MTAs. Nominally screened and qualified applicants submitted by Recruiting Stations and Districts could then be “boarded” during regional or national auditions, similar to the auditions hosted by other services.

In 2018, Sandberg demonstrated that there was a statistically significant relationship between metrics such as grade point average, Scholastic Aptitude Test scores, and the competitiveness of Marine Corps officer candidate selection boards. While Sandberg questioned whether or not such metrics were the best ones to select officer candidates, using musical audition scores in regional or national auditions may be an equitable metric to ensure the most qualified musicians are being enlisted into the Marine Corps. The most highly qualified applicants would then be offered an enlistment contract and processed by their local Recruiting Station, similar to the situation that already exists for the President’s Own U1 PEFs. Such a system may help alleviate some stress on the enlisted recruiting force and ensure the most qualified applicants are offered open positions. The appropriateness of such alternatives requires further research and consideration.

- (5) How can Big Data analysis software be used to enhance MCRC's awareness, efficiency, and effectiveness?

Although this study relied on the concepts of "Big Data" to guide its data management methodology, the analysis of 1,899 MEOP shippers over time is not inherently a "Big Data" problem. However, the historical data housed in the entire MCRIS RDBMS and other data warehouses within the Marine Corps and DOD may be prime candidates for the application of Big Data analysis software and even future Artificial Intelligence analysis platforms. The application of this technology may uncover previously unrecognized relationships that would greatly enhance MCRC's ability to tailor its recruiting practices.

F. CLOSING

This study was primarily concerned with asking what significant shifts in MEOP demographics have occurred over the last 15 years, and how these shifts could be identified using sound data management techniques and statistical analysis models. By doing this, the research team identified that there had been a statistically significant shift in the proportions of education levels of U2 PEF shippers over time. It also provided three general courses of action along with several recommendations to achieve them.

The business of recruiting can often take on an impersonal "numbers crunching" perspective, and it is easy to lose sight of the inherently personal relationship that develops between the Marine recruiter and the future Marine. Marine musicians are unique in that not only do they have to personally dedicate themselves to earning the title of "Marine," but they must also demonstrate proficiency in a difficult skillset prior to ever stepping on the yellow footprints of a Marine Corps Recruit Depot. Marine recruiters are challenged because not only do they have to find qualified applicants who can pass an audition, but they must gain the commitment of that individual to accept the challenge of earning the title of "Marine" and potentially serving in a combat environment, which is also not an easy task to achieve.

Anyone who has experience with Marines on recruiting duty knows how hard those men and women work to achieve their mission. While some other services have

recruiting “goals,” Marines have recruiting *missions* – and Marines do not accept mission failure whether it is on the battlefield or their recruiting monthly mission. That is the level of dedication they bring to recruiting duty. Amongst the many challenges Marines on recruiting duty face, ensuring that the annual MEOP mission is met can be amongst the most difficult. While the explicit goal of this research was inherently a “number crunching” exercise, its implied focus was the human element. The goal of that focus was to enable the tirelessly working Marine recruiter to find the talented musician who wants to serve their country and earn the coveted title of “United States Marine.” By identifying the trends noted in this study, the research team hopes to have helped alleviated at least some of the unnecessary difficulties the recruiter and the recruited must overcome, and hopes to have contributed to the overarching mission of the Marine Corps, which is to “make Marines, win battles, and return quality citizens” to American society (HQMC, 2018, Forward).

APPENDIX A. CHI-SQUARED EXCEL MODELS

The following figures are screen shots taken from the analysis models developed for this study. These models are shown in Figure 43, Figure 44, Figure 45, Figure 46, and Figure 47 in order to allow readers and future researchers to consider this study's methodological approach and to validate its findings.

Education Code at Contract	Fiscal Year													
Education Codes	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Row Total
7	1													1
10				1										1
11	109	87	93	65	66	59	53	32	39	36	30	26	31	726
12	49	54	50	56	60	58	44	44	35	48	51	51	47	647
13	3	3	3	2	3	2	3	3		2	1	1	5	31
14	1	1	2	1	2	1	2		2	2	5	5	3	27
15		3	2	2	2	2	3	5	4	3	5	9	8	48
16	5	7	7	5	6	6	11	12	23	12	29	21	16	160
17-19	2		1						2	5	3	1	5	19
Column Total	170	155	158	132	139	128	116	96	105	108	124	114	115	1660

Actual Frequencies	Fiscal Year													
Education Codes	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Row Total
11	109	87	93	65	66	59	53	32	39	36	30	26	31	726
All other codes	61	68	65	67	73	69	63	64	66	72	94	88	84	934
Column Total	170	155	158	132	139	128	116	96	105	108	124	114	115	1660

Actual Ratios	Fiscal Year													
Education Codes	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Act Ratio
11	64.1%	56.1%	58.9%	49.2%	47.5%	46.1%	45.7%	33.3%	37.1%	33.3%	24.2%	22.8%	27.0%	43.7%
All other codes	35.9%	43.9%	41.1%	50.8%	52.5%	53.9%	54.3%	66.7%	62.9%	66.7%	75.8%	77.2%	73.0%	56.3%

Expected Frequencies	Fiscal Year														
Education Codes	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017		
11	74.3494	67.7892	69.1012	57.7301	60.7916	55.9807	50.7325	41.9855	45.9217	47.2337	54.2313	49.8578	50.2952		
All other codes	95.6506	87.2108	88.8988	74.2699	78.2084	72.0193	65.2675	54.0145	59.0783	60.7663	69.7687	64.1422	64.7048		

Chi-square stat p-value	7.8808E-20	CHISQ.TEST Function
Chi-square stat value	119.4704	CHISQ.INV.RT Function
p-value result	< 0.01	
Weight of evidence	Overwhelming	
Conclusion	Reject null	

Ratios	11	≠/ 11	Total	% 11	% ≠/ 11
FY05-09	420	334	754	55.7%	44.3%
FY10-14	219	334	553	39.6%	60.4%
FY15-17	87	266	353	24.6%	75.4%
FY05-17	726	934	1660	43.7%	56.3%

Note: Data derived from Marine Corps Recruiting Command (2019, December 31).

Figure 43. Chi-squared test for Education Code at Contract “11.”

Education Code at Contract	Fiscal Year													
Uncorrected	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Row Total
7	1													1
10				1										1
11	109	87	93	65	66	59	53	32	39	36	30	26	31	726
12	49	54	50	56	60	58	44	44	35	48	51	51	47	647
13	3	3	3	2	3	2	3	3		2	1	1	5	31
14	1	1	2	1	2	1	2		2	2	5	5	3	27
15		3	2	2	2	2	3	5	4	3	5	9	8	48
16	5	7	7	5	6	6	11	12	23	12	29	21	16	160
17	2		1						2	5	3	1	5	19
18														0
19														0
12 SUB	-3	-2	0	-1	-3	-2	-2	-10	0	-6	-10	-6	-10	-55
12 ADD	1	1				1	1				2	1	1	8
13-19 ADD	3	2	0	1	3	2	2	10	0	6	10	6	10	55
13-19 SUB	-1	-1	0	0	0	-1	-1	0	0	0	-2	-1	-1	-8
Overall Delta	-2	-1	0	-1	-3	-1	-1	-10	0	-6	-8	-5	-9	-47
Corrected Column Total	170	155	158	132	139	128	116	96	105	108	124	114	115	1660

Corrected Actual Frequencies	Fiscal Year													
Education Codes	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Row Total
12	47	53	50	55	57	57	43	34	35	42	43	46	38	600
All other codes	123	102	108	77	82	71	73	62	70	66	81	68	77	1060
Column Total	170	155	158	132	139	128	116	96	105	108	124	114	115	1660

Actual Ratios	Fiscal Year													
Education Codes	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Exp Ratio
12	27.6%	34.2%	31.6%	41.7%	41.0%	44.5%	37.1%	35.4%	33.3%	38.9%	34.7%	40.4%	33.0%	36.1%
All other codes	72.4%	65.8%	68.4%	58.3%	59.0%	55.5%	62.9%	64.6%	66.7%	61.1%	65.3%	59.6%	67.0%	63.9%

Expected Frequencies	Fiscal Year													
Education Codes	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	
12	61.4458	56.0241	57.1084	47.7108	50.2410	46.2651	41.9277	34.6988	37.9518	39.0361	44.8193	41.2048	41.5663	
All other codes	108.5542	98.9759	100.8916	84.2892	88.7590	81.7349	74.0723	61.3012	67.0482	68.9639	79.1807	72.7952	73.4337	

Chi-square stat p-value	1.7900E-01	CHISQ.TEST Function
Chi-square stat value	16.2742	CHISQ.INV.RT Function
p-value result	>= 0.1	
Weight of evidence	Little to none	
Conclusion	Fail to reject null	

Ratios	12	≠ 12	Total	% 12	% ≠ 12
FY05-09	262	492	754	34.7%	65.3%
FY10-14	211	342	553	38.2%	61.8%
FY15-17	127	226	353	36.0%	64.0%
FY05-17	600	1060	1660	36.1%	63.9%

Note: Data derived from Marine Corps Recruiting Command (2019, December 31).

Figure 44. Chi-squared test for Education Code at Contract “12.”

Education Code at Shipping	Fiscal Year															
All other codes	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Row Total
7	1															1
10				1												1
11	2	2	3		1		1						3	3	2	17
12	153	135	137	120	118	111	91	64	72	77	72	70	66	82	65	1433
13	3	2	5	2	6	6	5	4	2	3	2	3	6	2	2	53
14	3	3	2	2	2	1	2	4	2	2	5	7	1	4	5	45
15	1	5	1	2	2	2	3	3	3	4	4	10	7	5	8	60
16	5	8	8	5	10	8	13	20	25	17	37	23	25	19	32	255
17	2		1					1	1	5	4	1	7	4	3	29
18			1				1							1	1	4
19															1	1
Column Total	170	155	158	132	139	128	116	96	105	108	124	114	115	120	119	1899

Actual Frequencies	Fiscal Year															
Education Codes	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Row Total
<=12	156	137	140	121	119	111	92	64	72	77	72	70	69	85	67	1452
All other codes	14	18	18	11	20	17	24	32	33	31	52	44	46	35	52	447
Column Total	170	155	158	132	139	128	116	96	105	108	124	114	115	120	119	1899

Actual Ratios	Fiscal Year															
Education Codes	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Act Ratio
<=12	91.8%	88.4%	88.6%	91.7%	85.6%	86.7%	79.3%	66.7%	68.6%	71.3%	58.1%	61.4%	60.0%	70.8%	56.3%	76.5%
All other codes	8.2%	11.6%	11.4%	8.3%	14.4%	13.3%	20.7%	33.3%	31.4%	28.7%	41.9%	38.6%	40.0%	29.2%	43.7%	23.5%

Expected Frequencies	Fiscal Year														
Education Codes	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
<=12	129.9842	118.5150	120.8088	100.9289	106.2812	97.8705	88.6951	73.4028	80.2844	82.5782	94.8120	87.1659	87.9305	91.7536	90.9889
All other codes	40.0158	36.4850	37.1912	31.0711	32.7188	30.1295	27.3049	22.5972	24.7156	25.4218	29.1880	26.8341	27.0695	28.2464	28.0111

Chi-square stat p-value	1.6378E-29	CHISQ.TEST Function	Ratios	<=12	Other	Total	% <=12	Other
Chi-square stat value	173.0734	CHISQ.INV.RT Function	FY05-09	673	81	754	89.3%	10.7%
p-value result	< 0.01		FY10-14	416	137	553	75.2%	24.8%
Weight of evidence	Overwhelming		FY15-19	363	229	592	61.3%	38.7%
Conclusion	Reject null		FY05-19	1452	447	1899	76.5%	23.5%

Note: Data derived from Marine Corps Recruiting Command (2019, December 31).

Figure 45. Chi-squared test for Education Codes at Shipping “≤12.”

Education Code at Shipping	Fiscal Year															
Education Codes	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Row Total
7	1															1
10				1												1
11	2	2	3		1		1						3	3	2	17
12	153	135	137	120	118	111	91	64	72	77	72	70	66	82	65	1433
13	3	2	5	2	6	6	5	4	2	3	2	3	6	2	2	53
14	3	3	2	2	2	1	2	4	2	2	5	7	1	4	5	45
15	1	5	1	2	2	2	3	3	3	4	4	10	7	5	8	60
16	5	8	8	5	10	8	13	20	25	17	37	23	25	19	32	255
17	2		1					1	1	5	4	1	7	4	3	29
18			1				1							1	1	4
19															1	1
Column Total	170	155	158	132	139	128	116	96	105	108	124	114	115	120	119	1899

Actual Frequencies	Fiscal Year															
Education Codes	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Row Total
13-15	7	10	8	6	10	9	10	11	7	9	11	20	14	11	15	158
All other codes	163	145	150	126	129	119	106	85	98	99	113	94	101	109	104	1741
Column Total	170	155	158	132	139	128	116	96	105	108	124	114	115	120	119	1899

Actual Ratios	Fiscal Year															
Education Codes	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Act Ratio
13-15	4.1%	6.5%	5.1%	4.5%	7.2%	7.0%	8.6%	11.5%	6.7%	8.3%	8.9%	17.5%	12.2%	9.2%	12.6%	8.3%
All other codes	95.9%	93.5%	94.9%	95.5%	92.8%	93.0%	91.4%	88.5%	93.3%	91.7%	91.1%	82.5%	87.8%	90.8%	87.4%	91.7%

Expected Frequencies	Fiscal Year															
Education Codes	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	
13-15	14.1443	12.8963	13.1459	10.9826	11.5650	10.6498	9.6514	7.9874	8.7362	8.9858	10.3170	9.4850	9.5682	9.9842	9.9010	
All other codes	155.8557	142.1037	144.8541	121.0174	127.4350	117.3502	106.3486	88.0126	96.2638	99.0142	113.6830	104.5150	105.4318	110.0158	109.0990	

Chi-square stat p-value	9.1419E-03	CHISQ.TEST Function	Ratios	13-15	Other	Total	%13-15	% Other
Chi-square stat value	29.4278	CHISQ.INV.RT Function	FY05-09	41	713	754	5.4%	94.6%
p-value result	< 0.01		FY10-14	46	507	553	8.3%	91.7%
Weight of evidence	Overwhelming		FY15-19	71	521	592	12.0%	88.0%
Conclusion	Reject null		FY05-19	158	1741	1899	8.3%	91.7%

Note: Data derived from Marine Corps Recruiting Command (2019, December 31).

Figure 46. Chi-squared test for Education Codes at Shipping “13-15.”

Education Code at Shipping	Fiscal Year															
Education Codes	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Row Total
7	1															1
10				1												1
11	2	2	3		1		1						3	3	2	17
12	153	135	137	120	118	111	91	64	72	77	72	70	66	82	65	1433
13	3	2	5	2	6	6	5	4	2	3	2	3	6	2	2	53
14	3	3	2	2	2	1	2	4	2	2	5	7	1	4	5	45
15	1	5	1	2	2	2	3	3	3	4	4	10	7	5	8	60
16	5	8	8	5	10	8	13	20	25	17	37	23	25	19	32	255
17	2		1					1	1	5	4	1	7	4	3	29
18			1				1							1	1	4
19															1	1
Column Total	170	155	158	132	139	128	116	96	105	108	124	114	115	120	119	1899

Actual Frequencies	Fiscal Year															
Education Codes	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Row Total
16	5	8	8	5	10	8	13	20	25	17	37	23	25	19	32	255
All other codes	165	147	150	127	129	120	103	76	80	91	87	91	90	101	87	1644
Column Total	170	155	158	132	139	128	116	96	105	108	124	114	115	120	119	1899

Actual Ratios	Fiscal Year															
Education Codes	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Act Ratio
16	2.9%	5.2%	5.1%	3.8%	7.2%	6.3%	11.2%	20.8%	23.8%	15.7%	29.8%	20.2%	21.7%	15.8%	26.9%	13.4%
All other codes	97.1%	94.8%	94.9%	96.2%	92.8%	93.8%	88.8%	79.2%	76.2%	84.3%	70.2%	79.8%	78.3%	84.2%	73.1%	86.6%

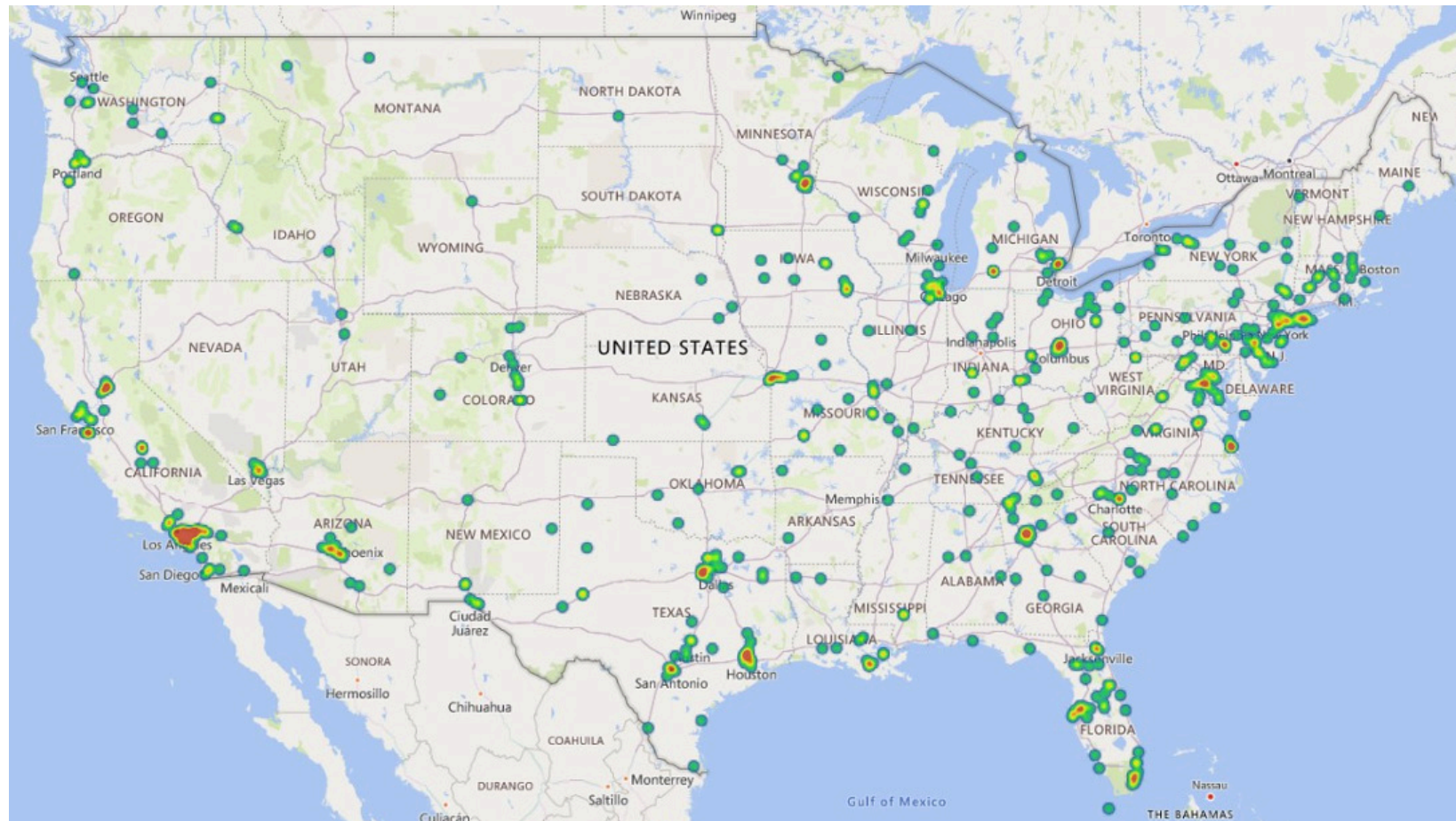
Expected Frequencies	Fiscal Year															
Education Codes	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	
16	22.8278	20.8136	21.2164	17.7251	18.6651	17.1880	15.5766	12.8910	14.0995	14.5024	16.6509	15.3081	15.4423	16.1137	15.9795	
All other codes	147.1722	134.1864	136.7836	114.2749	120.3349	110.8120	100.4234	83.1090	90.9005	93.4976	107.3491	98.6919	99.5577	103.8863	103.0205	

Chi-square stat p-value	6.7876E-21	CHISQ.TEST Function	Ratios	16	Other	Total	%16	% Other
Chi-square stat value	130.0032	CHISQ.INV.RT Function	FY05-09	36	718	754	4.8%	95.2%
p-value result	< 0.01		FY10-14	83	470	553	15.0%	85.0%
Weight of evidence	Overwhelming		FY15-19	136	456	592	23.0%	77.0%
Conclusion	Reject null		FY05-19	255	1644	1899	13.4%	86.6%

Note: Data derived from Marine Corps Recruiting Command (2019, December 31).

Figure 47. Chi-squared test for Education Code at Shipping “16.”

APPENDIX B. ZIP CODE HEAT MAP



Note: Data derived from Marine Corps Recruiting Command (2019, December 31).

Figure 48. Heat map distribution of U2 PEF zip codes for FY 2005–2019

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