

Discovering the Unique Assets of Veterans in Engineering: A Strengths-Based Thematic
Analysis of Veterans' Narratives

by

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ABSTRACT

Prior research has provided evidence to suggest that veterans exhibit unique assets that benefit them in engineering education and engineering industry. However, there is little evidence to determine whether their assets are due to military service or other demographic factors such as age, maturity, or gender. The aim of this study is to discover, better understand, and disseminate the unique assets that veterans gained through military service and continue to employ as engineering students or professional engineers. This strength-based thematic analysis investigated the semi-structured narrative interviews of 18 military veterans who are now engineering students or professionals in engineering industry. Using the Funds of Knowledge framework, veterans' Funds of Knowledge were identified and analyzed for emergent themes. Participants exhibited 10 unique veterans' Funds of Knowledge. Utilizing analytical memos, repeated reflection, and iterative analysis, two overarching themes emerged, Effective Teaming in Engineering and Adapting to Overcome Challenges. Additionally, a niche concept of Identity Crafting was explored using the unique narratives of two participants. This study provides empirical evidence of military veterans experientially learning valuable assets in engineering from their military service. A better understanding of the veterans' Funds of Knowledge presented in this study provides valuable opportunities for their utilization in engineering education and engineering industry.

DEDICATION

This work is dedicated to the military men, women, and animals who fought and sacrificed in the service of the United States of America.

ACKNOWLEDGMENTS

Thank you to all who have supported me in my pursuit of this doctoral degree. Without the support of my family, friends, and colleagues, I believe this journey would have been one fraught with far more intellectual and emotional challenges. It is sometimes easy for me to forget about the struggles along the way; remembering only the finish line and how it felt to cross it. However, this time around I will be making a concerted effort to remember the bumps in the road; not as past struggles, but as challenges faced and overcome with all of your help.

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CHAPTER 1

INTRODUCTION

The aim of this study is to discover, better understand, and disseminate the unique assets that 18 military veterans continue to employ as engineering students or professional engineers. These assets are all unique in that they were experientially learned or adopted during the participants' time in military service. I view the dissemination of this work as an excellent opportunity to share their stories. A strength-based analysis of the participant narratives was utilized and as I am not only the researcher, but also a member of the represented population, it seems appropriate that I share a portion of my story and how it led me to this specific research area.

In 2001, I was a Senior at Lynchburg College in Virginia. Following the September 11th attacks, I found myself at a crossroads. I could follow my head and attend graduate school, with the hope of moving toward a career in medicine, or I could follow my heart and join the military to add whatever value I could toward the defense of my country. After much reflection and against the advice of my family, I decided to follow the latter. I was an above average athlete with four years of collegiate track and field accolades, and I wanted to make the most of my upcoming time in service, so I decided to pursue a position within the special operations community. There was one significant problem though, if I were to pursue an officer's billet with my undergraduate degree there was no guarantee that I could try out for any special operations billets. As an officer I would have a chance, but no certainty for what I viewed as my one opportunity to enter into this specialized community and I feared that I would end up in a non-deployable billet, which went against all of my motivations for entering the US military.

With this knowledge I decided to reject the officer route, ignore my recently awarded undergraduate degree, and enlist in the US Navy. The majority of my peers were 18 years old and, if bootcamp can be a parallel to an academic institution, this was the first time I found myself as what can now be described as a nontraditional student. It was a difficult transition, but adaptation was quickly my strategy for success. I found that my prior experiences afforded me numerous assets that the majority of my peers did not hold. One such asset was an understanding of the attention typically received by individuals that were the best or worst in particular situations. I did not want this attention, so I attempted to be the *Gray Man*, the person that presents a level of performance that ensures they are never in danger of punitive actions, but not accomplished enough to be highlighted as an exemplar standard. This was not my aim for the entirety of my military service, but it seemed to be a strategy that could be advantageous during basic training until I faced my opportunity to prove my capabilities during the special operations entrance tests. Laughably, this strategy worked for about two days, until the Recruit Division Commander (RDC), known moreover as a Drill Instructor, decided I should be the Master at Arms for my division. This placed me in a position where becoming the *Gray Man* was an impossibility. Now everyone was to look to me as the example of what they should do and how they should act. The power to enforce rules and regulations had also become my burden, which negatively affected most of my opportunities to connect with my peers on a positive personal level. As aforementioned, I viewed this as a burden. However, after further reflection in the years to come, I began to recognize the strengths I had gained from that experience. It had served to build my understanding of the difference between leading and being a good leader, I had become much more patient

than in the past, I was able to recognize the asset of clear and concise communication, and I realized that my empathy for others had dramatically increased. I also began to understand the value of confidence in times of challenge. This last element was not always true, as I have seen instances when a false sense of confidence is detrimental for morale, but I found that it eased some of the stresses expressed by my peers I was tasked with leading. These were valuable assets that I may have developed much later in life, or not at all, if not for my experiences during the transition from civilian college graduate to military member.

I decided to pursue the rate (job title) of corpsman, with the intent that I would eventually become a combat medic and, as planned, after six months of basic training and general medical training, I was given the opportunity to enter into the training pipeline for special operations. I passed all entrance qualifications and began the two-and-a-half-year training pipeline to become a Special Amphibious Reconnaissance Corpsmen with the Marine Force Reconnaissance Company. This training presented a new level of challenge that was physical, mental, and sometimes emotional. However, with the completion of each subsequent training school, I felt I had gained valuable assets that would continue to benefit me during and after my time in service. As I now reflect on what these assets were, I think one of the most valuable aspects was a more thoughtful approach to the metaphorical battles that are worth fighting and the ones that are not. Another is that I would never again make major decisions without having weighed alternative options and developed potentially necessary contingency plans. However, the asset that I feel has been the most important as I have progressed through life is one born of the physical pain of running a 20-mile race carrying a backpack weighing over 100

pounds and having been diagnosed with kidney stones two days prior, the intellectual discomfort of stress tests and live tissue medical training, and the emotional challenges of combat deployments. “Nothing lasts forever and eventually everything comes to an end.” This perspective is not intended to be cryptic but uplifting. It has continued to provide me with a frame of mind that refuses to quit without having achieved success. For example, eventually the workday will end, and I will get to go home, eventually I will complete this race and have time to rest, and eventually I will graduate and have the opportunity to use my new assets for impactful works.

In 2009, I was honorably discharged from the US Navy and began pursuing an undergraduate degree in engineering. This transition had its own new challenges, that I have discovered since then were not limited to my experiences. However, I found that many of the assets that were gained through my military experiences were still quite appropriate for the rigor and stresses of undergraduate engineering. In fact, after graduation I was employed as an engineer and I came to find that my prior experiences, some of which I had believed to be a burden, had afforded me strengths I was continuing to use in the engineering industry and eventually as a physics instructor.

I am now a PhD candidate in Engineering Education Systems and Design and my experiences from military service continue to serve me well. Having reconnected with friends and colleagues from my past, I have had an opportunity to revisit memories and have found that there were a number of experiences that I do not actively reflect on and many I had forgotten until this reconnection. These connections and conversations afforded me memories of assets I had continued to utilize following my time in service. It felt heartening to have these conversations and memories become a part of my life again.

However, as I began to read scholarly works focused on veterans, I quickly realized that the majority of the literature was heavily deficit-based. An abundance of articles sought to highlight the challenges, perceived shortcomings, and emotional issues that so much of society has come to believe are synonymous with being a US veteran. The scholarly work was not malicious. Most of the works appeared to be designed in an effort to inform academic institutions, veterans' organizations, and medical providers of these veterans' problems in a call for action around preparing appropriate support. These negative publications did not align with my military or civilian experiences. My story and those of my peers led me to believe that there was another side to the conversations surrounding veterans; one that could shine a spotlight on their assets as opposed to their potential deficits.

It is with my narrative in mind that I wish to highlight the unique assets of other military members and veterans in engineering. It is my hope that this study may also lead my participants to better understand their unique assets, when they acquired them, and how they continue to use them in their lives. I believe that some of the strategies uncovered may be helpful for others as they move through times of challenge. These findings can later be disseminated to other military members, military veterans, veterans services agencies, and practitioners who are interested in acknowledging the challenges that arise in life but wish to learn the unique strategies of these 18 military members and veterans. The research question for this study is as follows:

In what ways do the experientially learned assets from military service continue to aid military veterans as engineering students and professional engineers?

CHAPTER 2

LITERATURE REVIEW

Introduction

Engineering organizations, institutions, and committees continue to drive the evolution of engineering expectations for students and professionals alike. The Accreditation Board for Engineering and Technology (ABET) student outcomes (ABET, 2018), *The Engineer of 2020* (National Academy of Engineering, 2004), and *The Goals of Engineering Education* (Goals Committee, 1968) are three of many instances in which important characteristics and traits of the modern engineer have been established. Prior literature suggests that a number of these sought-after traits are already present in many military veterans who decide to pursue engineering degrees (Knowles, 1984; Main et al., 2019; Sheppard, Kellam, & Brunhaver, 2019; Tavernise, 2011). My work is intended to elucidate these veterans' unique strengths as they relate to the field of engineering. I will uncover many of these veterans' traits that can be tied directly to their time in military service. With veterans entering engineering at increasing rates (Cate & Davis, 2016) there is a rare opportunity to capitalize on the value that they bring. A better understanding of the unique strengths held by veterans may serve as a call to action for their recruitment and support from the programs through which they matriculate.

Veterans in Higher Education and Engineering Education

Increasing Numbers of Veterans

Higher Education. Along with the engineering expectations surrounding student outcomes that parallel the modern culture and needs of engineering, there has been an increase in underrepresented groups within the engineering student population. One

example is the growing population of student veterans that may be well-suited to meet the evolving needs of engineering. Following the attacks on the World Trade Center on September 11, 2001 the US immediately delivered an ultimatum to Al-Qaeda, which was ignored. In response, the US launched Operation Enduring Freedom (OEF) with the stated goals of 1) ousting the Taliban regime, 2) capturing and prosecuting Osama Bin Laden and other Al-Qaeda leaders, and 3) permanently destroying Al-Qaeda's organizational capacities (Name Redacted, 2019). In March of 2003, as operations within Afghanistan continued, the United States launched Operation Iraqi Freedom (OIF), publicly signaling an intent to continue searching for weapons of mass destruction (Dale, 2009). With operations across the Middle East, this marked a period in history between 2001 and 2009 within which over 2 million US military personnel were deployed in more than 3 million tours of duty (National Academy of Sciences, 2010). Paralleling these deployments, there was an aggressive effort to increase the recruitment of personnel for military service. This increase in recruitment lasted almost the entire length of these conflicts, only returning to its pre-2001 rate after President Barack Obama laid out a withdrawal plan in 2009 (We Honor Veterans, n.d.).

With decreased operations overseas, the US military found its ranks to be bloated with nonessential personnel. Recruitment had been brought to a crawl, there was less of an effort to retain servicemembers who found themselves at the end of their enlistments, and leadership was advising many military members to accept early retirement opportunities. These actions, in part, led to the massive exodus of active duty military members and historically high rates of veterans enrolling in and attending undergraduate programs (U.S. Department of Veterans Affairs, 2018). The enrollment of these veterans

can be measured through the use of their Post 9/11 GI Bills and verified through student records. In the three years following 2008 almost 500,000 people had utilized their educational benefits (Armstrong & Haynie, 2015; McBain, Kim, Cook, & Snead, 2012). With this unprecedented number of veterans attending academic institutions, an effort was made to better prepare for continued increases in veteran enrollment. Officials at 690 academic institutions participated in a longitudinal study with surveys deployed annually between 2009 and 2012. In 2009 there was an average 156 student veterans enrolled across the 690 institutions, which grew to an average 370 in 2012. These surveys provided evidence of a 137% increase in veteran enrollment over this three-year period of time (McBain et al., 2012). With the expectation that veterans will continue to leave military service and enter into higher education, there is a need to learn more about this underrepresented group so as to better understand the unique assets they may bring with them to academic institutions.

Engineering Education. Paralleling the dramatic increase of veterans in higher education previously noted (Armstrong & Haynie, 2015; Cate & Davis, 2016; Faller & Burnham, 2015; McBain et al., 2012; Osborne, 2014; U.S. Department of Veterans Affairs, 2018; University Office of Institutional Analysis, 2018), there is further evidence that a large number of these student veterans are pursuing degrees in engineering (Armstrong & Haynie, 2015; Cate & Davis, 2016; University Office of Institutional Analysis, 2018). A study conducted at Syracuse University sampled over 8,500 veterans across multiple undisclosed academic institutions in 2015. They reported that 43% of their respondents' military jobs were directly related to Science, Technology, Engineering and Mathematics (STEM) fields, with the majority reporting an intent to

continue studying and working within their STEM fields (Armstrong & Haynie, 2015). A separate report presented by the Student Veterans of America (SVA) provided further evidence of veterans' interest and academic pursuits in engineering (Cate & Davis, 2016). This report utilized SVA chapters, on-campus veteran center directors, Veterans Affairs certifying officials, and social media networks to sample institutions across the United States. Within their sample of 1,352 student veterans, 31.3% were currently pursuing degrees in STEM and engineering, while 25.29% of the total 1,352 students were pursuing degrees within engineering alone (Cate & Davis, 2016).

A comparison across the prior work of Faller and Burnham (2015) and an Arizona State University report of student veterans and their majors (2018) presents a 71% increase in student veterans from 2015 (approximately 3,400 student veterans enrolled) to 2018 (5,815 student veterans enrolled). Of the most recently reported 5,815 student veterans enrolled at Arizona State University, 33% (1,919 student veterans) are enrolled in engineering degrees (University Office of Institutional Analysis, 2018). With close to one-third of the student veteran population pursuing degrees in engineering, there is a unique opportunity to learn more about the veteran population and what valuable assets they may be bringing into their engineering programs.

Desired Characteristics and Traits of Graduates in Engineering

A myriad of skills have been identified as being sought after in engineering education and engineering industry. Prior literature identified leadership and project management abilities (Brunhaver, Korte, Barley, & Sheppard, 2018; Bucciarelli, 2001; Davis, Beyerlein, & Davis, 2005), organizational skills (Brunhaver et al., 2018), an ability to work well with others in teams, heightened communication skills that span

organizational and cultural boundaries (Brunhaver et al., 2018; Bucciarelli, 2001; Davis, Beyerlein, & Davis, 2005; Stockman, Kincaid, Heale, Meyer, & Strong, 2017; Winters et al., 2013), and the motivation to efficiently complete tasks (Kenner & Weinerman, 2011) as being crucial within engineering. There are also skills such as information finding, time management, and work ethic that have been identified as important for engineers who wish to continue into industry (Brunhaver et al., 2018; Winters et al., 2013).

Many veterans entering into engineering programs already exhibit a number of these skills (Main, Camacho, Mobley, Brawner, & Lord, 2016; Main et al., 2019; Rabb, Bower, Barsanti, & Welch, 2017; Sheppard et al., 2019). Additionally, many veterans surpass traditional students with a higher level of confidence, decision-making, and understanding for the value of learning from others (Dwivedi, 2014; Stockman et al., 2017), which are important assets for engineers in industry. These assets held by many veterans align well with sought after traits in engineering students and professionals.

Scholars have historically evaluated engineering education to ensure that content, pedagogy, and student outcomes mirror society's trending changes and the needs of engineering that follow (Goals Committee, 1968; Grinter, 1955; Mann, 1918; Wickenden, 1930). There has been a documented emphasis on not only technical competence, but also language, writing, professionalism in engineering, and the idea of social impact (Wickenden, 1930). Similar to Wickenden's *Report of the Investigation of Engineering Education* (1930), the *Report of the Committee on Evaluation of Engineering Education* continued to explore curriculum that focused on students' professional development while also positing that professional engineers should be masters in their own fields (Grinter, 1955). The inclusion of field mastery, professional

development, and other non-technical components into the engineering curriculum was intended to facilitate the development of engineers with well-rounded knowledge, making them better-suited to gauge and meet the needs of their modern society (Goals Committee, 1968; Grinter, 1955).

In more recent years, efforts have continued to incorporate the needs of society along with the needs of engineering industry (National Academy of Engineering, 2004, 2008; National Science Board, 2007). There is an ongoing mission to graduate dynamic students with engineering knowledge well-suited for real world applications outside of the classroom (National Academy of Engineering, 2004). *The Engineer of 2020* (2004) contends that these dynamic engineering students must hold attributes intended to bridge the gap between pure technical rigor and the evolving needs of society. These sought after assets include strong analytical skills, practical ingenuity, creativity, communication, a mastery of business and management principles, the ability to lead, high ethical standards, professionalism, a dynamism, agility, resilience, and flexibility, and the drive to be lifelong learners (National Academy of Engineering, 2004, pp.54-56). Following suit with the evolving field, ABET has recently revised their Student Outcome Criteria (ABET, 2018). They include the following: 1) an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics, 2) an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors, 3) an ability to communicate effectively with a range of audiences, 4) an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must

consider the impact of engineering solutions in global, economic, environmental, and societal contexts, 5) an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives, 6) an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions, and 7) an ability to acquire and apply new knowledge as needed, using appropriate learning strategies. Industry professionals and accreditation boards have identified important engineering skills such as leadership, teaming, communication, and goal-orientation, which are aligned with military veterans' assets, even those without formal engineering training (ABET, 2018; Boeing, 2020; Main et al., 2016, 2019; Rabb et al., 2017; Sheppard et al., 2019).

Characteristics and Traits of Many Veterans in Higher Education

Veterans have heavily been viewed as a deficit-heavy population within the field of academia. There is a notable dearth of asset-based scholarly work investigating and highlighting their unique strengths. That is not to say there is none. Veterans are a smaller group within the *adult learner* population (Knowles, 1984) of nontraditional students, which has an abundance of research providing evidence of their prowess as students and STEM professionals. As nontraditional students, veterans can be differentiated from traditional students in five specific areas or actions 1) their concept of self, 2) the experiences of learning as adults, 3) their readiness to learn, 4) their orientation to learning, and 5) a heightened motivation to learn (Knowles, 1984). However, these assets are attributed more to their age and adult learner status and less to their veteran status (Brawner, Main, Mobley, Camacho, & Lord, 2016; Molina & Morse, 2017). Further

research has provided findings supporting being an adult learner as an asset during transitions into academic programs. Fleming et al. (2015) found that older students have a higher ability for self-advocacy, a trait that is a direct predictor of academic success. A separate study conducted in 2011 highlighted specific reasons as to why institutions should seek out nontraditional students and veterans (Kenner & Weinerman, 2011). Findings provided evidence that this population of adult learners are self-driven, hold valuable experience, are actively engaged in the learning process, and are task motivated, a term synonymous with Blaauw-Hara's (2016, p. 812) "drive to complete the mission."

Business Insider highlighted 10 experientially learned skills that are gained through military service, these skills included confidence, decision-making, and understanding the value of learning from others (Dwivedi, 2014). Another article presented the following four reasons why veterans are better students than traditional students: Veterans are more likely to graduate than traditional students, veterans consistently have a higher GPA than the national average, veterans pursue academically rigorous degrees, and veterans tend to prefer nonprofit and public schools (Bogue, 2017). Many veterans appear to be well-suited to an academic environment. However, the transition from military service to an often-conflicting civilian lifestyle can be one fraught with new challenges.

Characteristics and Traits of Many Veterans in Engineering

There is not an abundance of scholarly work that focuses on the assets of veterans in engineering, but notable evidence has been presented to bolster the fact that military veterans hold characteristics and traits that are valuable within the field of engineering. There is evidence that military experiences provide an excellent foundation for veterans

as engineering students. Veterans bring value to their engineering programs through elevated student abilities, practices, tenacity for success, teaming, and world perspective (Blaauw-Hara, 2016; Cate, 2014). Veterans involved in qualitative interviews and focus groups have also reported an inherent ability to lead and work well within multidisciplinary teams (Main et al., 2016, 2019; Rabb et al., 2017), a drive to be good leaders (Main et al., 2019), the motivation for success, and an ability to work efficiently when faced with difficult challenges (Kenner & Weinerman, 2011).

Outside of scholarly publications there are other numerous examples and references to the unique assets of veterans in engineering. EngineeringJobs.com (2015) claimed that, even with the popular misconception tied to academic experience gaps due to service and the stigma of service-connected disabilities, veterans may find themselves better suited than others to conquer the challenges of an undergraduate engineering program. The idea of veterans being better suited than others for engineering was further supported by a New York Times article stating that,

Due to extensive training, operations, and experiences that 99% of the people living in the United States have never encountered, veterans in engineering have the capacity to bring new skillsets, thought processes, and problem-solving techniques to the engineering community (Tavernise, 2011).

There is no lack of support for veterans and a willingness to highlight their engineering skills in online media articles.

A potential problem with the identification of the unique assets of veterans is the fact that veterans are a subgroup within the population of adult learners. Authors seeking to highlight the assets of veterans in engineering have noted that even some of their participants are not certain that their strengths such as leadership, teaming, a heightened

work ethic, and an ability to communicate effectively with their peers and faculty were gained from their time in military service, but may be attributed to non-military characteristics such as age, gender, and maturity (Brawner et al., 2016; Main et al., 2016; Molina & Morse, 2017). However, this lack of distinction surrounding the inception of potentially unique veteran assets provides a gap in the literature and offers a novel opportunity for further investigation.

This dissertation is an attempt to build on and expand previous work, utilizing an asset-based approach to identify and better understand the unique assets of veterans that are experientially learned through military service. In direct support of this work a pilot study focused on three student veterans in engineering (Sheppard et al., 2019). Within this small sample many notable assets reported as being experientially learned in the military were found to still be successfully employed in engineering and civilian life. The participants expressed a confidence in their willingness to lead with a better understanding of the difference between poor and exemplar leadership, the ability to make quick decisions under pressure, and a broader perspective that allowed them to grasp the gravity of situations inside and outside the engineering classroom (Sheppard et al., 2019). The continued expansion of this research, coupled with an appropriate asset-based framework, has the potential to unearth rich data and provide valuable insights for veterans in academic and professional engineering, engineering faculty, academic advisors, and management in industrial settings.

Transitions

Experiences During Transitions

In an effort to mitigate challenges associated with change, extensive work has been done to better understand human adaptations during transitions (Cooper, Goldberg, Milleville, & Williams, 2016; Schlossberg, 1981; Sheppard et al., 2019; Zinger & Cohen, 2010).

Prior studies have found that some challenges associated with major life transitions may include a lack of adaptive perspective, psychological disorders such as depression, problems adapting to their newly restructured society, and prior influences that are no longer appropriate for their new narrative (Abrams, 2006; Bussolari & Goodell, 2009; Ge, Conger, & Elder, 2001; George, 1993; Heinz & Kruger, 2001). Further studies have investigated correlations between academic and social successes with the ages of the individuals in transition (Fleming et al., 2015; Livingston, Havice, Cawthon, & Fleming, 2011; Main et al., 2016). When dealing more specifically with student transitions, Fleming et al., (2015) found that nontraditional students face greater challenges than those of typical traditional students. They are more likely to be married, have children, and balance a full-time job. This status of nontraditional student is held by all veterans who enter into college after their military service and it is understandable to assume that they may experience unique challenges due to the dramatic life change along with traditional transitional challenges.

Veterans in Transition

There has been much work surrounding veterans in transition as they leave the military, veterans with service-connected disabilities, and veterans with combat

experience. However, a review of prior literature revealed that the majority of this work was conducted using a deficit-based approach. After veterans leave the military they may soon experience a loss of support, feelings of isolation, and general difficulties associated with the extreme differences between military life and that of a civilian (Brawner et al., 2016; Lord, Main, Brawner, Mobley, & Camacho, 2016; Main, Brawner, Lord, Mobley, & Camacho, 2015; Main et al., 2016; Sheppard, Kellam, & Brunhaver, 2018; Sheppard et al., 2019). These and other challenges are not unique to veterans. However, prior research has found that they are more prevalent in dramatic transitions such as military discharge and traumatic events such as combat (Accamando, 2017; Diramio, Ackerman, & Mitchell, 2008; Persky & Oliver, 2011). These veterans may face challenges, linked to the traumatic experiences of combat and wartime, that greatly limit their capacity to be successful in the classroom and may further limit their social interactions with faculty and student peers (Ackerman, Diramio, & Garza Mitchell, 2009; Rumann & Hamrick, 2010). It is for this reason that the majority of veteran research ends in a call for institutional action. The intent appears to be disseminating a greater understanding of the veterans' needs in order to create support systems and programs that ease these potentially difficult periods of change.

It is of great importance that academic institutions be prepared to meet the needs of their students and provide any needed support (Persky & Oliver, 2011). Accamando (2017) found that few schools had the transitional programs necessary to appropriately assist veterans as they enroll in college. This included counseling, access to academic support, and aid in navigating the logistics of registration and matriculation for veterans as they utilize their Post 9-11 GI Bill funding (Accamando, 2017). This call to action is

not only to increase first year retention, but also to improve the veterans' chances for success. Diramio et al. (2008) worked to better understand the experiences of veterans as they returned from war, were subsequently discharged from the military, and then decided to enroll in undergraduate programs. Interacting with the student veterans, this study worked to develop a holistic approach for better assisting veterans as they enter and continue through their degree programs. Students described more emotional challenges such as trauma from wartime, a fear of being "called up" during a reserve period that followed their active duty, and the difficulties of interrupted coursework when such an event occurred (Diramio et al., 2008). Even as these studies are grounded in the deficits of their participants who are veterans, they raise excellent questions around actions that should be taken to assist veterans as they enroll as college students.

Service-connected disabilities may pose additional challenges within transitional periods, but prior literature has noted measures found to be effective in easing said challenges. One such measure is a program to assist wounded, injured, and ill veterans in transitioning into university STEM programs. This supportive measure utilizes a special emphasis on assistive technology and engineering to facilitate academic success (Cooper et al., 2016). Academic success centers and veterans service centers have also been found to be helpful for veterans, with and without service-connected disabilities, as they become students. Higher levels of support may be required to ease the veteran transition into student life, which evidence has shown can be provided by willing academic institutions (Faller & Burnham, 2015). Transitions of all natures have their own levels of challenge, but through gaining a better understanding of the people in transition, we gain

a better understanding of the support they may need and strategies they can utilize for success in the next phase of their lives.

Additional factors that must be considered when seeking to learn more about the veteran experience and issues they may encounter as they enter academic or professional fields is that of service-connected disability and the trauma of returning home after combat involvement (Ackerman et al., 2009; MacLean, 2010; Martz, Bodner, & Livneh, 2009). Following the OIF and OEF campaigns, we have been experiencing a dramatic increase in veterans with service-connected disabilities (Armstrong & Haynie, 2015; Branker, 2009; Burnett & Segoria, 2009; Church, 2009; Osborne, 2014). This last decade's conflicts have led to war-related injuries that carry over to service-connected disabilities. Service-connected disabilities may present unique deficits that require unique support from the veterans' institutions (Branker, 2009; Burnett & Segoria, 2009; Church, 2009; Osborne, 2014; Ostovary & Dapprich, 2011). A report conducted in conjunction with the SVA in 2015 found that 58% of veterans report a service-connect disability, and 79% of those indicating a service-connected disability, report their disability as an obstacle in transition. Of those who report an obstacle, 87% clarify that they feel this will negatively affect their personal life and 28% perceive it as a barrier to completing their education (Armstrong & Haynie, 2015). Student veterans have reported difficulties relating to other non-veteran student peers, including an inability to physically sit through longer class sessions and ambulatory challenges associated with physical injuries (Ackerman et al., 2009; Church, 2009; Diramio et al., 2008). A number of these disabilities have been described as *invisible*, such as Post Traumatic Stress Disorder (PTSD) and Traumatic Brain Injury (TBI), and have been found to be prevalent among

veterans returning from foreign wars (Shackelford, 2009). An invisible disability is one that is not visually recognizable. Along with PTSD and TBI that tend to affect people in a psychological or cognitive manner, invisible disabilities can also be physical in nature. Invisible disabilities can pose a series of unique challenges such as an inability to spend long periods of time seated in a classroom, negative effects on their sense of self, concerns about others' perceptions of veterans with disabilities, and potential decreases in cognition (Armstrong & Haynie, 2015; Church, 2009; MacLean, 2010; Shackelford, 2009; Sheppard et al., 2019).

With this increase in war-related injuries and service-connected disabilities, special care must also be used to understand and treat the symptoms of PTSD, which has been identified as a significant risk factor for suicide (Jakupcak et al., 2009). In addition to PTSD as a risk factor for suicide there are also perceptions of veterans and misconceptions of what PTSD “looks like” (Church, 2009). There is further evidence that the stigma of someone with PTSD may have ramifications on survivors of PTSD, creating a negative self image and an inability to share emotional experiences with the civilian community (Sheppard et al., 2018).

It is important to understand the potential deficits of an underrepresented population and prior literature has accomplished this at length. These previous studies have raised awareness of the unique challenges veterans face and has led to the development of transitional programs built to specifically address the needs of veterans (Accamando, 2017; Diramio et al., 2008). There is a far better understanding of veteran experiences than existed at the time of mass military discharges in 2008 and 2009. However, with these deficits fairly well exposed within the community of scholars and

practitioners, this provides a timely opportunity to shift the conversation and examine the unique assets that veterans develop during their time in military service. This study will serve to examine and disseminate the unique assets of a more niche underrepresented group, veterans in engineering.

Asset-Based Approaches

The critical theory framework centers on the theory, reflection, and action of changes in agency and the oppression of marginalized populations (Freire, 1968; Giroux, 2010; Mejia, Revelo, Villanueva, & Mejia, 2018; Secules, Gupta, Elby, & Tanu, 2018). Critical theoretical frameworks as a whole have been used to critique and question society, but that is not the comprehensive goal of this critical approach. The true purpose of critical theory is to provide a foundation for the transformation of society away from unfair power differentials, privilege, and oppression (Mejia et al., 2018). When using a critical theory framework focus is not only on the individuals within the system, but also on structures of inequality that serve to perpetuate the continued subjugation of marginalized and underrepresented groups (Giroux, 2010; Mejia et al., 2018; Secules et al., 2018).

As a critical theoretical framework, Funds of Knowledge also aim to empower marginalized populations, but this asset-based framework focuses more specifically on academic environments. Funds of Knowledge frame the identification of skills and knowledge learned in the households of marginalized communities (Moll, Amanti, Neff, & Gonzalez, 1992; Smith & Lucena, 2016; Wilson-Lopez, Mejia, Hasbún, & Kasun, 2016). The initial objective for the Funds of Knowledge framework was to connect household-learned knowledge to pedagogical practices in K-12 classrooms. The Funds of

Knowledge framework was utilized in the development of innovative pedagogies that integrated the classroom content with the Funds students learned in their households and from elders within their communities (Moll et al., 1992; Smith & Lucena, 2016; Wilson-Lopez et al., 2016). Funds of Knowledge has since evolved to address the alignment of students' household Funds with specific engineering practices (Wilson-Lopez et al., 2016).

Building on the works of Funds of Knowledge, Esteban-Guitart and Moll (2014) created the Funds of Identity framework. Funds of Identity are very well-connected to Funds of Knowledge and the asset-based approach to more clearly understand and represent the skills and knowledge of marginalized populations, but Funds of Identity address more deeply the concept of a person's identity (Esteban-Guitart & Moll, 2014; Moll et al., 1992; Smith & Lucena, 2016; Wilson-Lopez et al., 2016). This focus on identity allows for a more dynamic lens to discover who we are, who we are learning from, and the experiential knowledge gained from all aspects of our lives (Esteban-Guitart & Moll, 2014). A subtle difference between these two Funds frameworks is that knowledge allows for a structure of emergent Fund categories, whereas identity has a priori categories of *Geographical Funds of Identity*, *Practical Funds of Identity*, *Cultural Funds of Identity*, *Social Funds of Identity*, and *Institutional Funds of Identity*, within which emergent Funds are placed (Esteban-Guitart & Moll, 2014). Even with the characteristic differences between these critical theoretical frameworks, they have all been proven valuable in analyzing and disseminating the knowledge inherent in marginalized communities and returning agency to the individuals within them (Mejia et al., 2018; Secules et al., 2018; Smith & Lucena, 2016; Wilson-Lopez et al., 2016).

In addition to the interactions of these frameworks through their centralized focus on agency, empowerment, and community-based knowledge, there are also substantial interactions across their methods and findings. Secules et al. (2018), Smith and Lucena (2016), and Wilson-Lopez et al. (2016) apply their findings directly to engineering students and how their household Funds prepare them well for engineering academia, while Secules et al. (2018) and Smith and Lucena (2016) also pair Funds of Knowledge with critical theory to better understand the oppressive nature of engineering on marginalized people.

Giroux (2010) used critical theory to question the nature of education and societal influences on pedagogy. He posited that a lack of critical thinking and the absence of a critical pedagogy has served to marginalize a sizable number of students and communities. Furthermore, Giroux's work follows critical theory as a call for action to discontinue "teaching for the test" and develop a critical pedagogy in order to facilitate agency across all communities. Giroux's work served to inform the work of Mejia et al. (2018), which built on the ideas of new perspectives and a society that can move away from a positivist cataloging of marginalized communities. In agreement that there must be more in place than critical theory and theorizing (Mejia et al., 2018), this work aims to attain this goal, continue beyond theorizing, and provide valuable findings for practitioners within engineering. Reflection on available theory and the development of strategies are critical components for asset-based approaches if marginalized populations are to regain agency through these scholarly works. One such strategy was a narrative approach that allowed a marginalized student to identify oppressive ideologies affecting her agency (Secules et al., 2018). This narrative technique was used as an empowering

tool through which the student was able to entwine her experiences in a manner that displayed resistant capital over the oppressive nature of marginalized cultural motifs.

Similar to the empowerment elicited through critical theory, Moll et al. (1992) used the Funds of Knowledge framework to conduct an examination into household knowledge of working-class Mexican communities. Through the collaboration of researchers and local teachers, these Funds were then converted into culturally responsible pedagogies for K-12 curriculum. This innovative asset-based approach to education reform also shaped the future of pedagogy based on marginalized households' Funds of Knowledge. Funds of Knowledge was similarly applied to identify the household Funds that parallel engineering practices (Wilson-Lopez et al., 2016). Informed by the prior work of Moll et al. (1992), Wilson-Lopez et al. (2016) established a connection between the technical and social aspects of engineering and familial, community, and recreational Funds of Knowledge in Latina/o adolescents.

Esteban-Guitart & Moll (2014) identified aspects of the Funds of Knowledge framework which they felt were inadequate and sought to improve the asset-based framework. Building on the previous work of Moll et al. (1992), Funds of Identity was the expansion stemming from Funds of Knowledge (Esteban-Guitart & Moll, 2014). Funds of Identity incorporates visual methodological approaches, such as self-portrait and significant circle, a Venn diagram-like visual expression displaying aspects of the participant's life and their levels of importance (Esteban-Guitart & Moll, 2014). This framework also utilizes previously mentioned a priori categories for the comparison and classification of emergent Funds.

Asset-based frameworks and the approaches that emerge from them have uncovered new strategies for returning agency to marginalized communities and unearthed a plethora of skills and knowledge previously missing from scholarly works. However, there are notable gaps in this literature surrounding asset-based frameworks. Esteban-Guitart & Moll (2014) stated that there is a missing component in the Funds of Identity framework surrounding the construct of invisible funds, knowledge or values that the subject does not report because they are unaware of their existence. There is no a priori category for such Funds of Identity and therefore they are unrepresented within the findings of this model. A second opportunity for future work follows the creation of culturally responsible instruction methods and how they will actually affect student outcomes in their respective communities (Wilson-Lopez et al., 2016). A final area for future development in this research focuses on the theoretical ideology of critical pedagogy (Giroux, 2010). There is a strong theoretical argument for the implementation of such a pedagogy, but further reflection is needed to determine the exact manner in which such a pedagogy can integrate with our current academic environment. Mejia et al. (2018) found that the majority of asset-based work that uses critical theoretical frameworks is highly theoretical and without strategies to usher in positive change. With the necessary components of deep reflection and strategy, future work can facilitate the elimination of privilege, build on marginalized populations' strengths, and develop more robust pedagogical strategies that are able to meet the educational needs of all students.

The challenges that some veterans face as they transition from active duty military members to the academic and professional environments of engineering have been acknowledged. However, the purpose of this work is to further explore and uncover the

unique assets that veterans with military experience and training utilize as engineering students and engineering professionals. Due to its lack of categorical constraints, Funds of Knowledge framework, under the broader category of critical theory, will be utilized to attain the aforementioned research goals and further explore rich answers to the research question. Funds of Knowledge, used to describe how social networks create knowledge for well-being and survival, are typically developed within a familial household. However, these mechanisms of survival are present within all cultures. They just look differently depending on expectations and variation among groups. The Funds of Knowledge are actually distributed, exchanged, and developed in strategic ways through thick networks. Within this study the military served as the familial household for veterans and the thick network through which Veterans' Funds of Knowledge were developed. The Funds of Knowledge framework, aligned through the military household, will lend more flexibility for emergent themes to accurately align with the unique Funds military members and veterans utilize in engineering.

Conclusion

As the engineering education community continues to reform and evolve the ideal characteristics of engineers and the needs for engineering (ABET, 2018; Goals Committee, 1968; National Academy of Engineering, 2004), there is a unique opportunity to identify communities that may already exhibit an abundance of these characteristics. Having an understanding that many military veterans hold such engineering traits (Knowles, 1984; Main et al., 2019; Sheppard et al., 2019; Tavernise, 2011) and that they are entering into engineering at an increasing rate (Cate & Davis, 2016; Faller & Burnham, 2015; University Office of Institutional Analysis, 2018), I am

motivated to explore the inception of these assets to which they utilize as engineering students and professionals. Veterans may find the transition from active duty personnel to civilian uniquely challenging (Brawner et al., 2016; Lord et al., 2016; Main et al., 2015, 2016; Sheppard et al., 2018, 2019), but once these hurdles have been overcome veterans have the potential to bring exceptional value to their engineering programs and the engineering industry (Knowles, 1984; Main et al., 2019; Sheppard et al., 2019; Tavernise, 2011). However, there remains the question of whether or not veterans' unique assets are products of their time in military service or simply due to the fact that they are adult learners (Brawner et al., 2016; Main et al., 2016; Molina & Morse, 2017). I utilized intentional methodological steps throughout semi-structured interviews to identify the engineering-aligned assets that veterans report are due solely to their time in military service. Participants described specific situations during which these assets were experientially learned. Generating veterans' Funds of Knowledge in engineering through a thematic analysis of their narratives produced valuable information for academic institutions and industry professionals. This dissertation serves to provide institutions a better understanding of these veterans' assets, which can be used to elevate engineering programs through increased recruitment of veterans, an appropriate utilization of veterans' assets in the classroom, and by gaining the valuable skills that they have been found to bring with them into engineering.

CHAPTER 3

RESEARCH METHODS

The purpose of this study is to better understand veterans in engineering's individual narratives and attempt to identify themes connecting their experiences and the strengths that they report as being gained from military service. This chapter will discuss participant recruitment, the selection of research sites, data collection methods, the analytical procedures, reflexivity, study limitations, validity, reliability, and quality of the research methods.

Participants and Recruitment

Participant recruitment was conducted through three phases of demographic survey distributions. The demographic survey (see Appendix A), created in Qualtrics, was designed to facilitate purposeful sampling of potential participants in order to achieve maximum variation across demographic and institutional characteristics (Creswell, 2016, pp. 110–111). Attaining variability across participants was an attempt to achieve variety in the hopes of providing the richest illustration of the phenomenon. With the purpose of this study in mind, the sampling of participants was based on achieving variability across their age, gender, ethnicity, military branch of service, position while in the military (to include prior-officer or prior-enlisted status and job assigned), their length of service, combat experience if at all, level of service-connected disability if at all, education completed prior to service, and the length of transition period between active duty and their enrollment in an engineering program or into a professional engineering role. These demographic survey responses were compiled and reviewed in each phase of recruitment. Due to the current lack of representation of all genders and ethnicities in

engineering, special attention was paid to these characteristics, which were placed in the highest hierarchy of participant selection criteria. Following gender and ethnicity, variability across the branch of service, combat experience, and the presence of service-connected disability were targeted. The remaining demographic characteristics were important, as they serve to inform some aspects of the interview data, but the primary goal in participant selection was to ensure diverse representation and perspective within this study.

In the first phase of recruitment, universities ranked in both the top 10 of *Best Colleges for Veterans* or holding a *Gold Military Friendly Rating* were identified. The institutions identified in this phase of recruitment were Stanford University, Dartmouth College, Cornell University, University of California-Los Angeles, Georgetown University, University of Southern California, Carnegie Mellon University, University of Virginia, University of Michigan-Ann Arbor, New York University, University of California-Santa Barbara, University of North Carolina-Chapel Hill, University of California-Irvine, University of Rochester, Georgia Institute of Technology, and Arizona State University. The demographic survey and a brief research information sheet (see Appendix B), were distributed to the Offices of Veterans Services through an electronic link within an email. The email held a brief message, which described the purposes of this study and requested that a representative distribute the message to all of the veterans currently enrolled in engineering programs. A veteran receiving this distribution would access the research information sheet through the embedded link. At the bottom of the webpage displaying the research information sheet, the veteran was informed that accessing the next page, the demographic survey, would be used to establish consent for

participation in this study. However, it did not assume a responsibility or obligation to continue as a participant. It is unclear as to which institutions opted out of distributing the email to their veterans, but 49 responses were received. All of the information provided was separated from identifying personal information. Following the review of the demographic surveys, 11 participants were selected to be included in this study. They were contacted through their preferred form of communication to establish that they had an appropriate understanding of the study, their estimated time involvement, and to schedule a time during which data collection could begin. The 11 participants, and all future participants, were assigned pseudonyms to aid in their anonymity. It was assumed that more variability could be achieved with continued recruitment and heightened efforts to recruit from different institutions in farther stretching geographic regions.

The second phase of recruitment utilized snowball sampling (Allen, 2017), through which participants were asked to contact people that they believed would be appropriate participants for this study. Two participants were interested in assisting with this phase of recruitment. This produced an additional five responses. All of the information provided was separated from identifying personal information. Following a review of their demographic information, one potential participant was selected to be included in this study. With 12 participants, there still appeared to be an opportunity for more variation across participants' ethnicities and genders, so recruitment entered its final phase.

The third phase of recruitment included sampling The Pat Tillman Foundation. This organization was founded followed the death of United States Army Ranger Pat Tillman and focuses on building leadership for the future and the impactful works

veterans and their dependents generate for society (Fischer, 2019). As a Tillman Scholar, I had access to Tillman Connect, a private network reserved strictly for the Scholars and Tillman Foundation. A message was posted on Tillman Connect asking that any interested veterans who were also engineering students or engineers contact me through their preferred method of communication. There were 13 responses from veterans that were engineering students or professional engineers in industry. An email with the linked research information sheet and demographic survey was distributed to the interested potential participants. All of the information provided was separated from identifying personal information. Following a review of the demographic information, six participants were selected to be included in this study. With 18 veterans identified and consenting for participation in this study, a high level of variability had been achieved across the demographic characteristics of age, gender, ethnicity, military branch of service, position while in the military (to include prior-officer or prior-enlisted status and job assigned), their length of service, combat experience, if at all, level of service-connected disability, if at all, education completed prior to service, and the length of transition period between active duty and their enrollment in an engineering program. The final participant demographics are displayed in Table 1.

| Table 1 | | | | | | | | | | | |
|---------------------------------|------------|---------------|------------------|------------------------|------------------------|--------------------------|---------------|-------------------|----------|------------------------------------|--|
| <i>Participant Demographics</i> | | | | | | | | | | | |
| Pseudonym | Age | Gender | Ethnicity | Military Branch | Military Job | Length of Service | Combat | Disability | % | Education Prior to Military | Status in Engineering |
| Aaron | 28 | Male | White | Army | Medic | 5 Years | Yes | No | 0 | High School Diploma or Equivalent | 3 rd Year Undergraduate Student |
| Adam | 29 | Male | Other | Marine Corps | Infantry | 5 Years | Yes | No | 0 | High School Diploma or Equivalent | 3 rd Year Undergraduate Student |
| Anna | 27 | Female | Hispanic | Navy | Electrician | 6 Years | No | Yes | 50 | High School Diploma or Equivalent | 2 nd Year Undergraduate Student |
| Brian | 37 | Male | White | Navy | Aegis Fireman | 6 Years | No | Yes | 20 | Some College | Master-Level Graduate Student |
| Chris | 26 | Male | White | Navy | Electrician & Mechanic | 6 Years | No | Yes | 50 | High School Diploma or Equivalent | 2 nd Year Undergraduate Student |
| Daniel | 35 | Male | White | Marine Corps | Crew Chief | 10 Years 1 Month | Yes | Yes | 10 | Some Community College | 3 rd Year Undergraduate Student |

| Pseudonym | Age | Gender | Ethnicity | Military Branch | Military Job | Length of Service | Combat | Disability | % | Education Prior to Military | Status in Engineering |
|------------------|------------|---------------|------------------|------------------------|---|--------------------------|---------------|-------------------|----------|------------------------------------|--|
| John | 29 | Male | Asian | Marine Corps | Infantry | 5 Years | Yes | Yes | 80 | High School Diploma or Equivalent | 2 nd Year Undergraduate Student |
| Kristine | 33 | Female | Asian | Army | Engineer Officer | 5 Years | Yes | Yes | No | Bachelor's Degree | Engineer in Industry & Master-Level Graduate Student |
| Kyle | 30 | Male | White | Navy | EOD | 6 Years | Yes | Yes | 20 | Bachelor's Degree | Master-Level Graduate Student |
| Lisa | 37 | Female | White | Air Force | Intelligence Officer/ Special Operations | 11 Years | Yes | No | No | Bachelor's Degree | Engineer in Industry |
| Mark | 29 | Male | White | Air Force | Aircraft Armament Systems | 6 Years | No | No | 0 | Some Community College | 3 rd Year Undergraduate Student |
| Mary | 40 | Female | White | Navy | Electronics Technician | 5 Years | No | Yes | 30 | Some Community College | PhD-Level Graduate Student |

| Pseudonym | Age | Gender | Ethnicity | Military Branch | Military Job | Length of Service | Combat | Disability | % | Education Prior to Military | Status in Engineering |
|------------------|------------|---------------|---------------------------|------------------------|-----------------------------|--------------------------|---------------|-------------------|----------|------------------------------------|--|
| Matt | 27 | Male | White | Marine Corps | Flight Equipment Technician | 4.5 Years | No | Yes | 30 | High School Diploma or Equivalent | 5 th Year 4+1 Graduate Student |
| Patricia | 30 | Female | White | Marine Corps | Airframe Structure Mechanic | 4 Years 3 Months | No | Yes | 80 | Some Community College | 4 th Year Undergraduate Student |
| Ryan | 30 | Male | Asian | Marine Corps | Infantry | 5 Years | Yes | Yes | 80 | High School Diploma or Equivalent | 3 rd Year Undergraduate Student |
| Sharon | 27 | Female | Black or African American | Air Force | Radiology Technician | 6 Years 2 Months | No | No | 0 | High School Diploma or Equivalent | 2 nd Year Undergraduate Student |
| Tim | 32 | Male | Hispanic | Army | Engineer Officer | 7 Years | No | Yes | 60 | Bachelor's Degree | Master-Level Graduate Student |
| Zack | 30 | Male | Asian | Marine Corps | MARSOC | 4 Years | No | Yes | 70 | High School Diploma or Equivalent | PhD-Level Graduate Student |

Research Sites

This study was conducted using data accumulated from eleven academic institutions within the United States. Along with purposeful selection of participants for variability, there was a hope that university sampling would provide a similar source of institutional variability.

Institution Characteristics

The characteristics that were identified as being potentially important for diversity are as follows: 1) the size of the student population, 2) the geographic region of the institution, 3) the institution's status of public or private not-for-profit, 4) the Basic Carnegie Classification, 5) a comprehensive review of college and university investments in serving military and veteran students, and 6) top-ranked colleges and universities that participate in federal initiatives to help veterans and active-duty service members pay for their post-secondary degrees. All engineering programs within which participants were enrolled were accredited by the Accreditation Board for Engineering and Technology (ABET).

The student populations sizes, public or private not-for-profit status, and Basic Carnegie Classifications were determined through the utilization of the 2018 Carnegie Classifications database at <http://carnegieclassifications.iu.edu> (Carnegie, 2018), the geographic regions are based on 2018 American Society of Engineering Education zone and section assignments found at <https://www.asee.org/member-resources/sections-and-zones> (ASEE, 2018), and the rankings based on the comprehensive review of college and university investments in serving military personnel and student veterans was accessed

through the 2019-2020 *Military Friendly* website found at www.militaryfriendly.com (Military Friendly, 2019). Additionally, the top-ranked colleges and universities that participate in federal initiatives to help veterans and active-duty service members pay for their post-secondary degrees were identified through 2020 US News and World Reports *Best Colleges for Veterans* at <https://www.usnews.com/> (US News and World Reports, 2020). The institutions and their aforementioned characteristics are displayed in Table 2.

| Table 2 | | | | | | |
|--|-----------------|-------------------------------|--------------------------|--|--|--|
| <i>Academic Institution Demographics</i> | | | | | | |
| Academic Institution | Size | Geographic Zone (ASEE) | Public or Private | Basic Carnegie Classification | <i>Military Friendly Rating</i> | <i>Best Colleges for Veterans</i> |
| Arizona State University: Online | N/A (##) | Southeastern & Gulf Southwest | Public | N/A | Gold | #76 |
| Arizona State University at Polytechnic | Small (4,809) | Pacific Southwest | Public | Master's Colleges & Universities: Larger Programs | Gold | #76 |
| Arizona State University at Tempe | Large (51,164) | Pacific Southwest | Public | Doctoral Universities: Very High Research Activity | Gold | #76 |
| Harvard University | Large (31,120) | North East | Private Not-For-Profit | Doctoral Universities: Very High Research Activity | N/A | #2 |
| Massachusetts Institute of Technology | Medium (11,466) | North East | Private Not-For-Profit | Doctoral Universities: Very High Research Activity | N/A | N/A |
| Old Dominion University | Large (24,375) | Southeastern | Public | Doctoral Universities: High Research Activity | Gold | N/A |
| Pennsylvania State University | Large (47,119) | Middle Atlantic | Public | Doctoral Universities: Very High Research Activity | N/A | N/A |
| Princeton University | Medium (8,273) | Middle Atlantic | Private Not-For-Profit | Doctoral Universities: Very High Research Activity | N/A | N/A |
| Stanford University | Large (17,534) | Pacific Southwest | Private Not-For-Profit | Doctoral Universities: Very High Research Activity | N/A | #1 |
| United States Military Academy at West Point | Small (4,491) | Middle Atlantic | Public | Baccalaureate Colleges: Arts & Sciences Focus | N/A | N/A |

| Academic Institution | Size | Geographic Zone (ASEE) | Public or Private | Basic Carnegie Classification | <i>Military Friendly Rating</i> | <i>Best Colleges for Veterans</i> |
|-----------------------------|-----------------|-------------------------------|--------------------------|---|--|--|
| University of West Florida | Medium (13,040) | Southeastern | Public | Master's Colleges & Universities: Larger Programs | Top 10 (#5) | N/A |
| Villanova University | Medium (10,967) | Middle Atlantic | Private Not-For-Profit | Doctoral Universities: High Research Activity | Bronze | N/A |

Data Collection

Data was collected through the use of a semi-structured narrative interview, developed to reflect the strengths-based approach to qualitative research exhibited in the Funds of Knowledge theoretical framework (Moll et al., 1992; Secules et al., 2018; Smith & Lucena, 2016; Wilson-Lopez et al., 2016). Depending on the geographical location of the participants as they related to the interviewer, some interviews were conducted in-person, while others were conducted through the use of Zoom video conferencing software. All interviews were conducted in a private setting.

Local interviews were conducted in-person. Each of these interviews was recorded with two devices, a primary audio recorder and a secondary phone recording application. Prior to the interview session, participants were reminded that the interview would be recorded, that they could decide to discontinue the conversation at any time, that they could skip questions if they did not want to answer them, and that I would be using a pseudonym for their identification in the future. They were then asked if they had any questions before we began. None of the participants had questions at this time. The interview then began with an opening narrative statement, a period of active listening, and a question to follow (see Appendix C for the full interview protocol). The shortened interview protocol is provided below:

I'm interested in hearing your story of how you got to where you are today as an engineering student [engineer]. I'd like to learn more about your transition of leaving the military and beginning [continuing] your time in engineering.

[Active listening if the participant begins speaking]

I'm also interested in the unique strengths and skills you may have learned during military service. What are some of them and how do you use them today?

Analytic memos (Saldaña, 2016, pp. 54-55) were completed following the close of each interview. This served as a time for initial reactions, reflections, and the identification of valuable data points to revisit during the analysis of the data. One of the interviews was transcribed through the transcription services offered by Rev. However, I transcribed the remaining audio recordings. Care was taken to exclude all personal information that could lead to the identity of the participants. This included the use of pseudonyms and anonymization of any personally identifiable characteristics (e.g. details beyond the name of their academic institution, program specifics, and names of friends and associates).

For non-local participants I used Zoom video conferencing for the interviews. The audio was recorded in a similar manner as the previous interviews. However, the Zoom software was utilized as the secondary recording device. Directly following the interview, an analytic memo was completed as before. After the first long-distance interview, I noted that video conferencing interviews might be more effective if a rapport had been established beforehand.

To address the lack of rapport found to exist in the absence of in-person conversation, a short 5-minute “Meet and Greet” technique was added to the interview protocol. Instead of scheduling the full 60-minute interview to follow directly after participant selection, a shorter video conference call, or face-to-face meeting, was conducted. As per the full interview protocol displayed in Appendix C, the purpose of this first meeting was as follows:

Use zoom in advance to connect with the participant, share some experiences, clarify the study, emphasize the interest in their stories, and schedule the actual

interview. This can also serve to provide the participant with some time to reflect on their experiences.

These “Meet and Greet” sessions were found to build a stronger connection and were utilized for all of the remaining in-person and video interview sessions.

One additional tool was added to the execution of the remaining interviews, the use of Zoom to assist in transcription. Zoom video conferencing offers an automatic transcribing feature. The Zoom audio recordings were exported as video text track files, which were then converted into text. Testing its accuracy led to an understanding that it was far more efficient than transcribing from audio recordings alone. For the remaining interviews, both local in-person and remote, I recorded using Zoom and the transcription feature for the first pass of transcriptions. The transcripts were then reviewed and compared to the audio recordings to ensure they were accurate and clean of identifiable information.

Along with maximum diversity across participant demographics, another goal of data collection was to achieve data saturation (Fusch & Ness, 2015). Data saturation refers to a point when “no new information or themes are observed in the data” (Guest, Bunce, & Johnson, 2006). This appeared to be reached following the completion of interview 16. There were no additional insights in the analytic memos. However, two more interviews were conducted to further verify this saturation phenomenon.

Analytical Procedures

I applied strengths-based open coding (Saldaña, 2016, pp. 115-117) and thematic analysis (Saldaña, 2016, p. 185) to my narrative interviews. Analytic memos and repeated reflection (Saldaña, 2016, pp. 53-54) with my research team, comprised of Richard

Southee and myself, was also utilized throughout the identification of emergent themes and categorization of Funds of Knowledge. Codes were identified when participants expressed any strengths that they attributed to their military service. Strengths that were presented but were not expressly attributed to a participant's time in military service were not included in the codebook. As some participants expanded upon these strengths, situations were identified in which they expressed a continuing use of their experientially learned military strengths in their engineering curriculum or professional engineering careers. These instances were noted, and the codes were separated into two categories: strengths experientially learned during military service, which they continue to use in engineering and those that they do not. After each one-third of data were analyzed my research team met to conduct shoptalk (Saldaña, 2016, p. 231), discuss similarities and differences across our codes, and discuss potential Funds of Knowledge. This approach is similar to other studies using Funds of Knowledge such as Wilson-Lopez, Mejia, Hasbún, and Kasun (2016) and González and Moll (2002) who developed an unspecified coding strategy and categorized the Funds of Knowledge through an analysis of the emergent themes and iterative reflection. A visual representation of this coding and analysis plan is displayed in Figure 1.

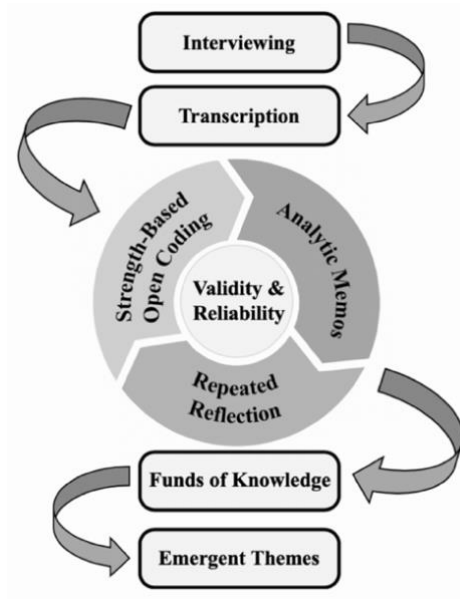


Figure 1. Data Collection and Analysis

Funds of Knowledge (Moll et al., 1992) that were exhibited by veterans involved in this study were developed through a thematic analysis. These Funds of Knowledge more specifically identify and categorized the experientially learned military strengths of these veterans as they related to their inception and their continued utilization within the participants’ academic engineering studies and professional engineering careers. Following the generation of these veterans’ Funds of Knowledge, shoptalk was used to discuss the similarities and overarching themes of the veterans’ Funds.

The following is a more specific example of the process through which Funds of Knowledge were identified and themes emerged. The code “effective communication” was exhibited by all of the participants. However, it was not referenced in the same manner by all of the participants. Some participants referred to this code as an ability to speak with student peers while others referenced their ability to communicate effectively as an asset that aided them as professionals in engineering industry. Still other

participants explained that they used their ability to communicate effectively as an asset they used to bridge potential power hierarchies within their engineering industry positions. The effective communication code was one that participants referenced across an abundance of uses and, as such, it was a code that held the place for a very versatile experientially learned asset. Because effective communication was exhibited in such a dynamic manner there was a high probability that it could be used to construct different veterans' Funds of Knowledge. Within this example, the iterative review and discussion of the codes, their similarities and differences, and the interactions within specific situations of use led the research team to decide that effective communication bolstered the identification of the *Interpersonal Communication Spanning the Team Environment* fund. This is not a claim that effective communication was attributed only to the *Interpersonal Communication Spanning the Team Environment* fund, but that effective communication paired with building a rapport and managing confrontation to form a strong skillset, which many of the participants utilized in interpersonal communications and professional relationships. The following chapter will present the findings of this study organized by theme. Additionally, two narratives will be shared to illustrate the complex and nuanced ways that participants discussed their experiences. Excerpts for codes such as effective communication that were exhibited by all of the participants were selected based on their richness and the depth to which they explained the continued use of assets in engineering. As such, there were some participants whose excerpts were not featured as data for the findings of this study.

The other Funds of Knowledge were identified in the same manner. The research team reviewed transcripts and created the codebook in an iterative manner during which experientially learned military assets were not only identified, but also categorized due to their continued utilization within engineering. Following the identification and categorization of the veterans' Funds of Knowledge, the funds were then analyzed and discussed to examine their similarities, overlaps, and continued practical applications in engineering. This final analytic process served to draw connections between the veterans Funds of Knowledge and led to the emergence of themes. The final codebook of strength-based codes is displayed in Table 3.

| Table 3 | | | |
|------------------------|---|---|---|
| <i>Codebook</i> | | | |
| Code | Definition | Inclusive Criteria | Illustrative Excerpt |
| Teaming | Individual has experiences that contribute towards working in a team and collaborating with other people | Key terms include synonyms of: teamwork, teaming, collaboration, working together. Specific notions of: working collaboratively with other people | We worked a lot with the SOF communities and just being part of a small team, learning how to not only lead but follow in that kind of small team environment, and build a really cohesive unit. I think it is [an] incredibly valuable skill. At school especially, we work a lot in small teams to solve problems. – Kyle |
| Building a Rapport | Individual has experiences that helps in building groups of people and connecting with others who have resources of use for them | Key terms include: rapport, networks, networking | I think that was learned, when I was in the military. Cause you can even talk about the military being whatever business you want it to be. But the reality is, day to day, it's a people business you. You're in a team all the time. There's people that report to you and you report to someone senior, so you have to understand that you have to build those skills. You have to build that rapport with both the people that work for you and the people that you work for. And that was definitely something I learned in the service, no question about it. No question about it. – Brian |
| Communication | Individual has experiences that lend toward efficiently expressing their thoughts, views or instructions | Key terms include: communicate, explain, discuss. Specific notions of: good communication skills, ability to convey thoughts | I learned how to talk to people and that's probably one of the biggest compliments I get from other people, as I'm very good at speaking across lines to people, conveying messages, and being very sensitive about how information is handled. – Sharon |
| Managing Confrontation | This code represents the individual has experiences that lends towards managing confrontation in a way that lends towards a positive resolution | Key terms include: confrontation, conflict, resolution. Specific notions of: resolving and managing conflict | I'm anti-confrontational most of the time, and there was one thing I learned from that first engine room on the ship. Sometimes confrontation is just what you have to do. Like, if you never get mad at somebody and you never tell them what you think then a lot of times they just kind of don't care what you think. – Chris |

| Code | Definition | Inclusive Criteria | Illustrative Excerpt |
|-----------------|---|---|---|
| Discipline | The state of order and obedience among personnel in a military organization and is characterized by the prompt and willing responsiveness to orders and understanding compliance to regulation. | Key terms include: discipline. The notion of a state valued in the military for following orders and staying on task no matter what you are facing. | Some classes are difficult in the sense that it took hours and hours and hours of studying. I mean, I had no motivation, but I had a lot of discipline. And that's the biggest thing. You can be unmotivated during the entire class because you have a discipline to, you know, finish up the homework and just get through the end...There's a difference between motivation and discipline and once people realize that it might help them a little bit more. You might hate the class you're going to, but you got to finish it. It's on your transcripts. You gotta do it. So, discipline might help them realize that, "Hey, once I get this over with. It's over forever. – Matt |
| Military Values | Characteristics such as loyalty, duty, respect, selfless service, honor, integrity, and personal courage. | Key terms include: core values. The notion of the shared core values across military branches. | The Army definitely values transparency and directness and that was something that was valued by my classmates. – Tim |
| Leadership | This code represents that the individual had experience being a leader or was comfortable taking the lead | Key terms include synonyms of: leadership, commanding, instruction, teaching. Specific notions of take charge, leading, managing or bringing order | From previous leadership roles and stuff like that, I can tell when, you know, this group is just disorganized. Like, someone needs to step up and I guess that it's helpful with that. So, if someone does need to step up I'll step up and be like, "Hey, we need to get this fucking done.", and then, you know, get the ball rolling. And so, I guess it helps with that aspect. – John |
| Adaptation | This codes represents that the individual has experiences that lends towards quickly responding to new information or responsibilities | Key terms include: adapt, adjust, modify, roles. Specific notions of taking on new/changing responsibilities with ease | All of that stuff [military training] is very relevant to the business world because the business world is constantly changing...I think that the military does prepare you to do anything. You know you have to mold yourself to be up to the task. – Kristine |

| Code | Definition | Inclusive Criteria | Illustrative Excerpt |
|-------------------------|--|--|---|
| Quick Learner | Individual is able to acquire and utilize skills and new information quickly and with ease | Key terms include: quick learner, fast learner, comes naturally. Specific notions of: learning fast, with ease | You have so many different jobs that you just learn to immediately look at something and be able to just like, "Okay, show me really quickly. I got it down." – Aaron |
| Bureaucratic Navigation | Individual has experiences that help in navigating complex bureaucratic systems | Key terms include: bureaucracy, navigation. Specific notions of finding what you need, utilizing people | It was about like interagency coordination and that you wanted to like talk to everyone early and often. You know, even if you knew the CIA would hate your plan or if you knew that state department would hate your plan at least go talk to them early so you can adjust your plan early in the planning cycle. – Lisa |
| Making Connections | Creating relationships with people to develop mutually beneficial situations | Key terms include: connection, personal, interactions. Specific notions of knowing the right people who may aid or facilitate the mitigation of needs. | Yeah, making these connections would end up paying off because they respected me I guess. And maybe talk to me more honestly and openly than they would with other managers...I was probably perceived more as management than as one of them, but, as I was going around and connecting with them on a personal level, I guess they trusted me more. – Tim |
| Entrepreneurship | The pursuit of opportunity beyond resources controlled. | Key terms include: entrepreneurship, limited resources. The notion of doing more with less or finding creative solutions to problems. | When I was a platoon leader I actually felt like I started exercising those skills that are necessary for entrepreneurship. So, I was a route clearance platoon leader. We were kind of out in the middle of nowhere and, you know, very limited in resources and support. – Kristine |

| Code | Definition | Inclusive Criteria | Illustrative Excerpt |
|-------------------|--|---|---|
| Resourcefulness | Individual has experiences that lend toward the positive use of resources and ability to make-do with limited resources | Key terms include synonyms of: resourcefulness, improvising, creative. Specific notions of: utilizing tools or “making do” | Anybody who's ever served, like, you know how to work hard, how to succeed. You were taught at one point how to find information to get what you need done. – Chris |
| Goal-Oriented | Being able to set goals, monitor one's own progress, and work persistently without procrastinating. | Key terms include: goals, objectives, target aim. The notion of staying on mission to accomplish the original and ultimate task/s. | I think in the military...a lot of people are goal or objective-oriented and are keen on taking action as well, and that is something that I have found to be highly valuable. – Tim |
| Broad Perspective | This code represents that the individual has experiences that gave them a wider perspective/world view | Key terms include: outlook, perspective, viewpoint. A notion of understanding the importance of situations relative to those of objective great importance. | I guess that's probably one of the biggest things. When you go through boot camp or SOI or any training evolution, some really shitty training evolutions I know, okay, well it's only gonna last a month. At the end of this month, it's gonna be worth it. It's gonna be done, it's gonna be over worth it and then the work I put into it is the work I get out. That helped me a lot with the whole engineering thing. – Ryan |
| Prioritization | Individual has skills or experience that contribute towards organizing tasks, duties and life in such a way that emphasizes their priorities | Key terms include: priorities, self-awareness, focus, refocus. Specific notions of: working towards a goal, priorities, maturity | But I think like with the veterans like for me I'm like, like, I don't really care about getting perfect score. For it's you know it's sort of, it's just easier to look at the big picture and focus on, “Okay, what do I really need to achieve?” – Lisa |

| Code | Definition | Inclusive Criteria | Illustrative Excerpt |
|-------------------------|---|---|---|
| Time Management | This code represents that the individual has experiences that drive them to be lucrative with their time and focus on meeting deadlines | Key terms include: time, time management, resources, limited time, scheduling. Specific notions of: time management, schedule | Having a rigorous schedule and having things planned out accordingly [in the military]. Like every single day. That actually really helped me to kind of carry that into setting up working hours for my studies when I was an undergraduate engineering student. – Brian |
| Sense of Urgency | This code represents that the individual has experiences that drives their decision-making process with a certain amount of purpose and urgency | Key terms: urgent, distraction, purpose. The notion of moving through tasks with purpose and avoiding procrastination. | There's a lot of social aspects of college that I just wasn't interested in when I went back to school. I was just, it was all business when I got there, I wanted to knock out what I wanted to knock out and get going. – Brian |
| Attention to Detail | This code represents that this individual has experiences that called for attention to smaller things and minor details. | Key terms include: detail, minor details, and small things. | So, that [attention to detail], that's a valuable lesson. I think in engineering it's the same way. Like, there's no halfway point. You either designed correctly and it's going to work, or it's not gonna work. I think that that causes military veterans or military, I guess active duty, to be really cognizant of doing things to standard – Kristine |
| Perceptions and Reality | A belief one's reality is directly tied to the perceptions of those around them. | Key terms include: perception, reality, expectations. The notion that we are what others see us as. | The biggest thing that we were taught in MARSOC is the concept of perception is reality. And that's one of the biggest things that I've learned. That the way that some organization or some group sees you, regardless of if it's real or not, is how they will treat you. They'll modify their behavior based off of what they perceive as your background. It's kind of like a shortcut, a psychological shortcut, that people kind of apply and that's honestly what happens with veterans all the time. – Zack |
| Taking Initiative | Individual has experiences that contribute towards the individual taking control of situations and making decisions without guidance/instruction. | Key terms include synonyms of: initiative, decision making, "just do it". Specific notions of: lacking specific guidance, command presence. | The networking. I always go out to these events where I meet, like, really up there individuals that could possibly fund me financially. I make sure I've not, like... I actually go out and apply for funding and actually look for these exciting opportunities. – Zack |

| Code | Definition | Inclusive Criteria | Illustrative Excerpt |
|--------------|--|---|---|
| Perseverance | Doing something despite difficulty or delay in achieving success | Key terms include: persistence, tenacity, determination, resolve, patience, endurance | I think my military experience really just gave me the ability to embrace the suck. Right. You're just able to get through the shit, wake up tomorrow, do it again, and get through it. Honestly, I think that allowed me to persevere after the military. – Mary |
| Work Ethic | Individual has experiences that contribute to a strong work ethic and willingness to put in work. | Key terms include synonyms of: hard work, urgency, willingness to work, Specific notions of working harder than others, or lack of effort from others | Oh, yeah, this is something I teach my students now as an instructor. Perseverance, right? Even though I fell in a hole of grease, I still continue on to get the job done. That is something that my bosses have always said is a benefit to them. Even if I screwed up, I break it, I blow it up, or I don't know what I'm doing, I won't quit until we're done. I'll figure it out. Just to get the job done. I'm a mission first kind of person, and I think the military enhanced that in me. – Mary |
| Resilience | Individual has experiences that contribute towards being resilient to stressors and high pressure. | Key terms include synonyms of: resilient, strong, strength, endure. Specific notions of: persevering through stressors or problems | The military really gives you resilience. Because resilience is something that you can't teach you just have to go through life right off the bat, as you go through basic training and you have to work with your team and you go and you get yelled at and you mess up, and all sorts of things, right? You're expected to perform under stress and with high expectations. – Kristine |

The thematic analysis of veterans' narratives led to the emergence of two overarching themes, Effective Teaming in Engineering and Adapting to Overcome Challenges. Additionally, narratives of two participants, Zack and Mary, who utilized many of the veterans' Funds presented rich and nuanced narratives surrounding their use of identity crafting.

Reflexivity

My reflexivity presented both strengths and challenges as the study was conducted for several reasons (Peshkin, 1988). First, I am a member of the population I am studying as was described in chapter one. It is my belief that these shared experiences or similarities in my background with the participants' backgrounds afforded an opportunity for the development of a unique rapport between my participants and myself. I had the ability to understand more of the military jargon and subtle details of deployment and service that were not examined during data collection but were helpful in later reviewing the transcript conversations. A number of participants have openly stated that they would not have divulged such detailed and in-depth narratives with a researcher who was not also a member of their veteran community. I understand that this connection between researcher and participant can lead to a certain level of inherent bias, which was addressed throughout the analysis period of this study. More specificity on mitigating my biases is described in the validity, reliability, and quality section of this document.

I have very vivid memories of my military experience. These experiences have had a clear effect on my studies in engineering, and I expect the same may be true for my fellow veterans who have also decided to pursue degrees in engineering or work in a

professional engineering capacity. In fact, my contemplation and reflection of how experiences during and following my time in military service affected both my academic and professional careers drives this very research. I have been utilizing my experiences from military service, engineering studies, and time working in the engineering and education industry to better understand the transitions that follow military service. Initially, my scholarly work surrounding student veterans in engineering focused on the challenges and difficulties associated with their transitions from active duty military to civilian engineering students. However, I am more specifically interested in gaining a better understanding of the strengths that are experientially learned during military service and how they may be further utilized during transitional periods and throughout the continuing veterans' work in engineering. Ultimately, it is my hope that my experiences have offered a unique approach to this study and thereby benefit veterans and other hidden communities by uncovering and highlighting the positive strengths they can utilize against future challenges in engineering.

Limitations

One limitation of this study was that some participants were unable to remember the correlation between their assets and the military events or experiences that inspired them. An attempt was made to utilize the Critical Incident Technique during the data collection phase of this study. However, it did not fully elucidate the military origins of all of the participants' assets.

Additionally, there may be further value to be uncovered through the investigation of different sample sizes and demographic characteristics. As this study was not intended

to create a generalization across all veterans in engineering, the sample size of 18 was appropriate for the research question posed, but investigations into larger sample sizes may have provided new and unique veterans' assets.

The sample size was quite diverse across participants' ages, their transitional time between military service and engineering, and their years of experience in engineering industry. This diversity provided a heightened level of variability, but there may be more interesting correlations to be discovered if the scope of demographic characteristics were narrowed. However, with an understanding of these potential limitations and their implications, this study successfully generated veterans' Funds of Knowledge as they related to both their experiences as military servicemembers and their time in engineering.

Validity, Reliability, and Quality

As referenced in my reflexivity, there are many commonalities between myself and the participants within this study. With this understanding, was a possibility that I may misinterpret or inject personal bias into the themes that emerge through data analysis or even in the organization and coding of data. I took steps to ensure that my potential biases were used as strengths and that they did not create a divergence between the participants' narratives and a misinterpretation of emergent themes. I was fortunate enough to retain a student employee for my research team, Richard Southee, a former Army medic who is now a graduate student. He is using qualitative methods to conduct research surrounding linguistics and PTSD. Following his addition to the IRB approved research team, Richard reviewed all of my transcripts for accuracy. Holding a good

understanding of military jargon, the logistics of deployments, and similar experiences of basic training in the military, Richard also assisted in the analysis of the data as a *Critical Friend* (Costa & Kallick, 1993; Glossary of Education Reform, 2013). Because Richard is also a veteran there was concern that confirmation bias may occur. This concern was mitigated through the continual use of shoptalk with the committee Chair and members of the committee. As scholars who possess an understanding of this data and are not military veterans, they were included throughout the data analysis process to ensure that potential biases, not recognized by myself or Richard were avoided.

As the iterative coding process continued, the research team met on a regular basis to discuss findings and ensure a lack of personal bias. To aid in maintaining validity and reliability, we engaged in shoptalk as a research team and inter-coder reliability (Saldaña, 2016, p. 231). Shoptalk allowed for opportunities to discuss the effectiveness of the analytic approaches, initial findings, and emergent themes as a research team. Inter-coder reliability involved comparing my coding outcomes with those of Richard. Additionally, participants were be consulted through member checking to verify that specific findings and emergent themes aligned with their perspective and personal narratives (Saldaña, 2016, p. 37). This iterative process confirmed the absence or presence of personal bias, which was then discussed within the research team, allowing a better understanding of the appropriateness of measures taken to mitigate potential current and future biases.

In an effort to convey transparency for the quality of this data collection there should be elaboration on the aforementioned use of the Critical Incident Technique

during the interview process. The Critical Incident Technique (Flanagan, 1954) appeared to be a method to better elicit the experiences of participants. It has been used in many areas and is commonly focused on the experiences of students (Coleman, 2006; Douglas, Douglas, McClelland, & Davies, 2015; Douglas, McClelland, & Davies, 2008). More specifically, it has been used to investigate student transitions (Moore & Popadiuk, 2011; Palmer, O’Kane, & Owens, 2009) and their resultant sense of belonging (Sedgwick & Rougeau, 2010), which are appropriate topics to be discussed with this study’s sample. Moreover, researchers have used the Critical Incident Technique to better understand students’ reported importance of peer connection as a strategy for healing (McCormick, 1997), their perceptions of effective learning strategies (Victoroff & Hogan, 2006), and to gather experiences from professionals in engineering (Hanson & Brophy, 2012). As this technique is over 60 years old, Bott and Tourish (2016) conducted a more recent reevaluation to ascertain whether Critical Incidents are still appropriate for building broad theory. This reevaluation provided supportive evidence that Critical Incidents are still appropriate for modern scholarly works (Bott & Tourish, 2016).

However, the narrative approach to rich data collection did not always merge well with the exploration of Critical Incidents affecting the participants’ experiences. There was an attempt to use this technique, but as the participants were able to express feelings and emotions about the strengths they gained during military service and continue to utilize in their lives now, many were unable to connect them to specific Critical Incidents of inception. With this acknowledgement, there was a hope that the participants would identify Critical Incidents that helped to form their experiences and strengths, but as

interviews continued it was evident that many provided rich narratives without the direct identification of such incidents. Even though all of the participants were not able to make inceptive connections through Critical Incidents, this technique was successful in identifying many experientially learned strengths and their continued use within engineering.

Throughout the data collection, handling of data, and analysis, great care was taken to maintain the validity and reliability of the findings. Additionally, in an effort to generate quality research, the potential limitations of this study were taken into consideration and addressed when possible. The analysis uncovered two emergent themes, comprised of 10 experientially learned Funds of Knowledge. Additionally, an interesting phenomenon surrounding two participants' narratives and their reflections on the concept of identity crafting was identified. These themes, Funds of Knowledge, and the narratives of two participants who use identity crafting are discussed in-depth in the following chapter.

CHAPTER 4

FINDINGS

The strength-based thematic analysis of these veterans' narratives revealed a number of Funds of Knowledge and themes surrounding the participants' experientially learned military assets. Some broad Funds, like leadership and military values, were expected, while others, such as storytelling to relate to other engineers, were quite unexpected. Finding that veterans may bolster academic and professional successes by combining identity crafting with an ability to use storytelling as a method of communication was an interesting concept to uncover.

This analysis identified 10 experientially learned Funds of Knowledge stemming from the participants' time in military service and two emergent themes. The first theme, **Effective Teaming in Engineering**, emerged from the interactions of the following Funds of Knowledge: *Interpersonal Communication Spanning the Team Environment*, *The Usefulness of Military Values Within Engineering Teams*, *Knowing How and When to Lead*, *Exemplary Work Ethic*, and *Building Beneficial Networks*. The second theme, **Adapting to Overcome Challenges**, was built from *Exemplary Work Ethic*, and *Building Beneficial Networks* as well, but included the following additional Funds of Knowledge: *Navigation Systems Through Organizational Learning*, *Managing Resources to Overcome Challenges*, and *Mission Completion Driven by Prioritization and Perspective*. Each of these themes are presented in bold section headings with their associated Funds of Knowledge following in bold and italicized headings. While the majority of these Funds of Knowledge are specific to individual themes, *Exemplary Work Ethic* and

Building Beneficial Networks were found to be prevalent across all emergent themes. As such, they are not presented as the other Funds of Knowledge are, with individual italicized subheadings within their associated theme.

Along with these two overarching themes, two participants, Zack and Mary, exhibited a majority of the Funds of Knowledge as they worked toward completing their engineering degrees and achieving success in engineering industry. Zack and Mary exhibited two unique Funds of Knowledge not apparent in the other participants: *Creating Perceptions to Build a Reality* and *Building a Reality to Meet Preconceived Perceptions*. This final section is a focused exploration of these two participants' narratives, their use of these Funds of Knowledge, and their use of identity crafting to frame their realities. Table 4 displays the themes with their associated Funds of Knowledge.

| Table 4 | |
|---|--|
| <i>Emergent Themes and Funds of Knowledge</i> | |
| Theme | Fund of Knowledge |
| Effective Teaming in Engineering | <i>Interpersonal Communication Spanning the Team Environment</i> |
| | <i>The Usefulness of Military Values Within Engineering Teams</i> |
| | <i>Knowing How and When to Lead</i> |
| | <i>Exemplary Work Ethic</i> |
| | <i>Building Beneficial Networks</i> |
| Adapting to Overcome Challenges | <i>Navigation Systems Through Organizational Learning</i> |
| | <i>Managing Resources to Overcome Challenges</i> |
| | <i>Mission Completion Driven by Prioritization and Perspective</i> |
| | <i>Exemplary Work Ethic</i> |
| | <i>Building Beneficial Networks</i> |
| *Identity Crafting | <i>Creating Perceptions to Build a Reality</i> |
| | <i>Building a Reality to Meet Preconceived Perceptions</i> |

Effective Teaming in Engineering and Adapting to Overcome Challenges were overarching themes that involved the majority of participants. As such, these themes are presented broadly, with multiple excerpts from different participant transcripts. Conversely, the section focused on Identity Crafting is presented as a deeper exploration into the rich narratives and nuances of two participants, Zack and Mary. This chapter serves to further explore these Funds of Knowledge and their relationship within the emergent themes of veterans' experientially learned assets.

Theme 1: Effective Teaming in Engineering

Following with evidence from prior literature, a majority of the study participants referred to aspects of teaming that they learned during their military service. This ability to work well in teams was a major theme exhibited by all participants. Brian, a Navy Firefighting veteran, remarked, "All the service members, you know, they get [the] team thing all the time. You're always thinking about the team." As the United States military completes its operational and logistical objectives through the utilization of cohesive and multidisciplinary teams this comes as no surprise. This idea of a cohesive multidisciplinary team is important in the field of engineering and in engineering education. As engineering may be represented as systems within systems, there is a continual need for professionals in independent and overlapping areas of expertise. As a prior Air Force healthcare professional, now undergraduate engineering student, Sharon saw her military team experiences as a parallel to her teaming mindset that she continued to employ in the healthcare industry.

And having kind of this mindset of, like, step back and see the bigger picture.

How do we all play into this? Not just our department, but how does radiology impact pharmacy that impacts lab because we're usually all grouped together.

How do we all as a team code, work together, and then how does our team work with the other teams? – Sharon

She spoke of the positive effect military teaming has had on her civilian job, but Kyle, a Navy Explosives Ordnance Disposal veteran, related his experience in military teams to his ability to work effectively in academic teams.

We worked a lot with the SOF communities and just being part of a small team, learning how to not only lead but follow in that kind of small team environment, and build a really cohesive unit. I think it is [an] incredibly valuable skill. At school especially, we work a lot in small teams to solve problems. – Kyle

The following Funds of Knowledge provide unique evidence for experientially learned assets from military service that align well with effective engineering teams. More specifically, participants referenced building their understanding for the value and utilization of interpersonal communication, incorporating their military values within their engineering teams, and more dynamic leadership roles within teams.

Interpersonal Communication Spanning the Team Environment

Interpersonal communication is comprised of many smaller facets that all work in tandem to allow for the exchange of information and feelings through verbal and nonverbal cues. Building a rapport, effective communication, and managing confrontation form a strong skillset to be utilized in interpersonal communications and professional relationships. The participants shared stories in which the importance of knowing the right people or being connected to individuals with skills they did not hold

were vital to the completion of engineering tasks. They felt their ability to work within their teams, communicate clearly and concisely, and reach out to those outside of the team lines gave them an enhanced capability to face challenges such as item procurement, the mitigation of team conflict, and complex engineering problems.

Participants voiced the importance of interpersonal communication in engineering and some believed this began with the ability to connect with others and build a strong rapport. Brian spoke at length about his understanding of the value of building a rapport with his team members. He also mentioned that team rapport must be established for effective communication between those who you report to and those who report to you, a lesson that he learned while serving in the military.

I think that was learned, when I was in the military. Cause you can even talk about the military being whatever business you want it to be. But the reality is, day to day, it's a people business. You're in a team all the time. There's people that report to you and you report to someone senior, so you have to understand that you have to build those skills. You have to build that rapport with both the people that work for you and the people that you work for. And that was definitely something I learned in the service, no question about it. No question about it. – Brian

Beyond the military, the use of a proper rapport is an asset that continued to serve veterans in engineering education. When discussing engineering education and industry, participants acknowledged that engineering is not a field of individuals alone. This is true in both industry and engineering education. Former Air Force Aircraft Armament Specialist, Mark, was a student at Stanford University following his time in the military. He understood the value of building a rapport in his teams, but, moreover, he stated that rapport was helpful as he engaged with faculty. Mark believed that his engagement with faculty was important for his continued success in engineering endeavors. “My ability

and willingness to establish a kind of connection when needed or to network with faculty is particularly helpful.” Participants reflected on their abilities to build rapport with peers, faculty, and supervisors, but acknowledged that this is only one small aspect of interpersonal communication. It opens the door for opportunities to communicate and share information effectively, which was also referenced as an asset gained through military service.

I learned how to talk to people and that's probably one of the biggest compliments I get from other people, as I'm very good at speaking across lines to people, conveying messages, and being very sensitive about how information is handled.
– Sharon

Clear verbal communication and the sensitive nature of some messages is an important trait that participants used within engineering education and industry. It is important to note that, in this digital age, communication is often conducted through email. Mark mentioned that his time in service had provided him with the ability to communicate one-on-one or electronically. He explained, “I definitely have noticed that my ability to communicate has been very beneficial. I feel like the military definitely taught me how to communicate effectively, be that via email or just even in person.”

Another aspect of interpersonal communication that is often necessary in an engineering team environment is the ability to manage and mitigate confrontation. Participants presented two different outlooks on managing confrontation: 1. Confrontation is inevitable so there is value in proactively communicating with peers and 2. Be direct and use evidence to support an argument. When Chris was working as an engine room mechanic aboard his Navy ship he quickly learned that conflict is an unavoidable aspect of his job. Therefore, he realized that he had to embrace his ability to

communicate his feelings with those around him. This respectful communication allowed him and his peers to better understand one another and he felt that this bond allowed for better ongoing communication.

I'm anti-confrontational most of the time, and there was one thing I learned from that first engine room on the ship. Sometimes confrontation is just what you have to do. Like, if you never get mad at somebody and you never tell them what you think then a lot of times they just kind of don't care what you think. – Chris

This is an asset that Chris continued to use in his engineering education teams. He continued to use this open sharing of feelings to bond with teammates and facilitate open interpersonal communication.

Daniel had a different outlook on managing confrontation; one that was less emotional, more transparent, and more direct. He believed that tact may not always be the best strategy in closing a confrontation and preferred to use supporting evidence and engineering content to strengthen argued stances within his engineering teams. Faced with an argument about tasking within his engineering team, Daniel remembered saying, "I know that's not the answer you want, but here's why." Upon further reflection he explained that giving orders for the sake of giving orders had always frustrated him during his time in service. Therefore, he explained his perceived importance in remaining cognizant of the reasons behind giving tasks or making team decisions.

The participants' abilities to build rapport, communicate efficiently, and manage confrontation make up important aspects of the interpersonal communication asset that they continue to utilize as engineering students and professionals. However, interpersonal communication is not the only experientially learned asset that makes them effective as

teammates. There is also a universal set of military values that all branches of the United States military are built upon.

The Usefulness of Military Values Within Engineering Teams

Each branch of the United States military was founded on core values, which they impart upon all service members. For example, the Marine Corps has three core values: honor, courage, and commitment. Similarly, the Army adopted seven core values: loyalty, duty, respect, selfless service, honor, integrity, and personal courage. The American military members are trained to think, act, and fight with these values always in mind. As such, some participants referenced these core values and the fact that they continued to use them when working in their engineering teams.

Tim, an Army veteran, mentioned that he has carried his core values with him into engineering. He felt that his embodiment of respect, honor, and integrity was appreciated by his classmates and teammates. They provided him with a firm foundation upon which he felt comfortable maintaining transparency and the ability to communicate clearly. Tim referenced a benefit of these core values, saying, “The Army definitely values transparency and directness and that was something that was valued by my classmates.” Tim also explained that, following his completion of his engineering degree, the Army core values continued to be appreciated by peers in his professional life. Similar to Tim’s use of his core values in engineering, Matt, a Marine Corps veteran, found that honor and commitment continued to be one of his strongest assets in engineering. These two core values aided him in the development of self-control, which he referred to as discipline. He believed that personal discipline was in constant use across his engineering

assignments and that it is a concept he attempted to convey to his team members in times of team disorder or when they lacked the motivation to accomplish the team mission.

Some classes are difficult in the sense that it took hours and hours and hours of studying. I mean, I had no motivation, but I had a lot of discipline. And that's the biggest thing. You can be unmotivated during the entire class because you have a discipline to, you know, finish up the homework and just get through the end... There's a difference between motivation and discipline and once people realize that it might help them a little bit more. You might hate the class you're going to, but you got to finish it. It's on your transcripts. You gotta do it. So, discipline might help them realize that, "Hey, once I get this over with. It's over forever." – Matt

Speaking about these core military values, participants appeared to believe that there is a strong connection between military values and an exemplary work ethic that many veterans display. This relationship allows veterans to complete time sensitive tasks, surmount difficult assignments, and facilitate the success of their engineering teams.

Knowing How and When to Lead

Understanding and utilizing an ability to lead and follow well, while appropriately taking initiative to improve opportunities for success within an engineering team is a Fund of Knowledge exhibited by all participants. However, they did not all claim to be good and capable leaders. They indicated an understanding of what makes an effective leader and believed they had a strong comprehension of their own abilities to lead others. Parallel to the concept of leadership skills learned through military service, participants also displayed an understanding of what it meant to be a good team member, acknowledging that at times they had found stronger roles within their teams as supportive members.

Even though many of the participants could not remember specific instances during which they learned about the values of appropriate leadership, they all agreed that

they had honed these leadership skills during their military service and that they continued to use this asset in their engineering teams. One participant even noted that he believed his employers would expect him to be a leader simply because he is a veteran. Tim explained, “I think something the army puts a lot of value on is leading by example. Um, I know in my current job I will be expected to be on site and leading.”

Many of the participants voiced different facets of leadership they felt were important, but some agreed on the importance of knowing your mission, creating a concrete team structure, appropriately delegating tasks, and working as a cohesive unit. Aaron explained, “The natural things that come to mind is like, ‘Okay, who’s going to do what? Let’s start breaking down the roles.’ Maybe not necessarily a command structure, but at the very least a work structure.” Anna also explained the importance of delegating tasks,

Kind of oxymoronic to say it that way, but there’s a lot more delegation that goes on in the military, as far as in your group. It's like, let's all sit down, let's get this focus, and I love that people make time to do that. Like, let's actually sit down in the same room and it's not just, “you do this, and I do that, and we're going to hope it all gets done.” – Anna

These facets of leadership were necessary during military service, especially when in a life-threatening situation, and continued to be of aid for the participants as they worked in academic engineering teams.

Additionally, some participants recalled specific times during which they took initiative and reluctantly served as leaders of their engineering teams. Even when faced with a lack of interest in being the team leader, participants voiced an ability to assess the actions of the team, recognize the challenges they were facing, and generate solutions to drive their team over challenges they were facing. It appears that these veterans often find

themselves taking on leadership roles in their engineering teams simply because no one is willing or interested in taking charge and the team is operating in a disorganized manner.

When I got out here...freshman and sophomore year I did notice that a lot of people I've worked with were more on the timid side or shy side. They were smart, they just weren't ready to be leaders and managers. So, the majority of my projects I did take leadership roles. And that did stem from the military. – Matt

Similar to Matt's experiences, John had learned during his time in the military how an organized and cohesive team should operate. This understanding allowed him to recognize teams that were disorganized and without direction.

Unlike the majority of participants who cannot remember the inception of their leadership abilities, one Marine Corps veteran remembered the first time he decided to step into a leadership role well.

Honestly I didn't really have that oh shit moment until I distinctly remember[ed] this one fire fight we got into. We actually call it the Battle of Thanksgiving because it happened on Thanksgiving day. The first team leader, he got shot in the ankle and it was the first team, so they were heading the patrol. We were crossing this open area and then we got into an L-shaped ambush. Pretty much he went down and there was something wrong with his SAW [gunner]. His SAW was going down...But then, almost instantly, without even thinking about it, it was almost like an out-of-body experience. I was like, "Hey!" I told my SAW gunner to get up there and then I started coordinating. Seeing that [the] first team had a casualty and they can't get their main gun up, and the other two are just kind of returning fire, but they had such a heavy volume of fire coming at them. Two M-16s can only do so much, right? Instantly, having those guys push up, maneuver around, find a good spot so we could get the casualty back to us...After that was all said and done, I almost did it instinctively, then [I was] thinking, "Oh shit dude, I did some cool shit back there just now. That was some real team leader shit." – Ryan

Having recognized his ability to lead personnel in combat, Ryan continued to lead his teams in engineering education. Finding himself at times surrounded by a team without direction and effective leadership, he would identify their objective, assign tasks or steps to be taken, and maintain accountability for task completion.

When I realized it was just turning into a gaggle fuck, I was like, "Hey man, we really need to study." Someone had to step up and be a leader and be like, "Hey, this is our objective. We need to start studying for this shit, otherwise we're all gonna fail the test. Or we're just wasting time here." Everyone's thinking it. Everyone's like, "Oh yeah, that's true. That's why we got together with a study group because all our grades suck and we wanted to get better." But for some reason I notice a lot of people are on the same page, but no one ever steps up. I guess that's where that leadership stuff comes in. It's just kind of like, "Hey dude, we need to do this." Someone needs to step up and tell them, "Hey, this is what needs to happen." – Ryan

These veterans made it clear that they felt leadership is necessary for success in engineering and that they were willing to lead their teams if need be. Even if these veterans were reluctant, their experientially learned leadership assets were of paramount value for their engineering teams.

Theme 2: Adapting to Overcome Challenges

The second theme uncovered during this study is the veterans' beliefs that they gained an innate ability to adapt and overcome challenges as they continued forward with their post-military lives. Within the scope of this work, this relates specifically to their adaptation in solving all manner of problems encountered during the pursuit of their engineering degrees and their engineering careers. This asset of adapting and overcoming challenges is something they attributed to their time in military service and one that they reflected upon when referencing subsequent engineering challenges. In the cases of some participants, this was a concept as simple as understanding the need to readjust their approach with respect to the problem at hand. Anna described periods of time during which she had to adapt, "And so, I learned a whole lot too from doing that. Like I had to readjust the way I did things on a different ship and so I try to do that now because, like, I'm fully aware." As Anna explained, she learned to readjust when in a different context

in the military and recognized the importance of the need to be adaptable and flexible in her work and studies. As an engineer, Kristine echoed this sentiment as she explained that the military and business world are similar in that they are often changing.

All of that stuff [military training] is very relevant to the business world because the business world is constantly changing...I think that the military does prepare you to do anything. You know you have to mold yourself to be up to the task. – Kristine

As an aid in their adaptation, participants recognized that they had needed to become quick learners in order to remain adaptive to unique problems. This was an asset that aligned well with their perceptions toward, and execution of, adaptive behavior strengthened by new knowledge and skills. Military experiences had prepared them to be quick learners, which strengthened their adaptability while efficiently flattening their learning curve for new content. Aaron described the importance of being a quick learner. “You have so many different jobs that you just learn to immediately look at something and be able to just like, ‘Okay, show me really quickly. I got it down.’” Similarly, Mary explained, “So, I was able to really pack in a lot of experience in a short amount of time.” This theme of adapting to overcome challenges afforded many participants the ability to quickly and enthusiastically learn new things, while concurrently utilizing their new knowledge to surmount hurdles in academia and industry.

Navigating Systems Through Organizational Learning

Some participants referenced their high self-efficacy in building beneficial networks and the forming of connections to navigate potentially challenging bureaucratic systems. These connections and navigation have been attributed to their time in military service. The participants stated that this was quite valuable when entering into

engineering programs and getting acquainted to their engineering careers. This may allow for opportunities to better navigate complex organizations and connect with those who bring unique value to aid in the problem-solving process. Navigating systems through organizational learning is an asset that they continued to use in industry, especially with item procurement and making connections with those who may help them complete tasks. Navigating systems through organizational learning also provided a foundation for navigating the sometimes-complex task of procuring GI Bill funding.

One participant, Lisa, a female in Special Operations noted that she learned how to adapt and overcome challenges through her work with the CIA in the Middle East. For Lisa, adaptation became a necessary skill that she learned primarily while participating in the planning phases of overseas operations. The systems she was navigating were centered in interagency operational planning. As such, she mentioned there was a need to learn about the people and organizations with which she and her unit were collaborating. As a leader in her Air Force Intelligence and Special Operations unit, Lisa was coordinating and connecting with other government agencies to ensure that plan adjustments could be made and instituted prior to combat operations. She explained,

It was about like interagency coordination and that you wanted to like talk to everyone early and often. You know, even if you knew the CIA would hate your plan or if you knew that state department would hate your plan at least go talk to them early so you can adjust your plan early in the planning cycle. – Lisa

Lisa spoke to an indoctrination by fire in terms of learning how to adapt to shifting operational planning and the value of being connected to the right people at the right time. These were assets she used in order to adapt to the everchanging bureaucratic environment of collaborative combat situations. Following her active duty service, Lisa

continued to use her understanding of system navigation and organizational learning in her management of an engineering team within a large technology company.

Tim could not recall the specific instance when he learned the value of making connections and how that would aid him in navigating complex professional and bureaucratic industry systems, but he continued to use this military asset in his engineering internships. He used building beneficial networks and making connections as an opportunity to share more of himself with his supervisors and peers in engineering. Creating these relationships allowed him to build trust and become further ingrained within organizational structures.

Yeah, making these connections would end up paying off because they respected me I guess. And maybe talk to me more honestly and openly than they would with other managers...I was probably perceived more as management than as one of them, but, as I was going around and connecting with them on a personal level, I guess they trusted me more. – Tim

Aside from the use of these assets in industry, Patricia reflected upon her ability to navigate difficult aspects of academic projects through teammate support, communication, and mutual respect, which she attributed to her military experiences. This allowed her the ability to communicate with the right people and procure necessary supplies to aid her teams during engineering projects.

Managing Resources to Overcome Challenges

Many of the participants referenced different resources that they procured, managed, and utilized during past military operations, academic engineering projects, and professional engineering positions. During their military service resources including, but not limited to, perishable items such as rations, ammunition, field equipment, and personnel. As these veterans transitioned into their engineering pursuits, they continued

to use resource management to overcome challenges related to academic engineering assignments and professional engineering projects. This analysis led to a belief that the resource management Fund of Knowledge exhibited by these participants is likely formed out of their entrepreneurial mindsets and a broad general resourcefulness.

Kristine described entrepreneurship and her entrepreneurial mindset as an asset that provided her the “ability to do more with less,” an experientially learned asset that she continued to use as an engineer, entrepreneur, and social activist. Kristine stated that she began to recognize and utilize entrepreneurship when she was an engineering platoon leader in the US Army.

When I was a platoon leader I actually felt like I started exercising those skills that are necessary for entrepreneurship. So, I was a route clearance platoon leader. We were kind of out in the middle of nowhere and, you know, very limited in resources and support. – Kristine

It is interesting to note that entrepreneurship was not referenced in instances of invention or making new things, but more as a learned ability to procure and manage the resources necessary for overcoming unique challenges. As an engineering graduate student at MIT and MBA student at Harvard Business School, Kristine used her entrepreneurial mindset to successfully complete engineering problems that spanned beyond a purely technical nature, overlapping into the scope of engineering solutions for societal problems.

The concept of general resourcefulness was evidenced predominantly by participants’ pursuing their undergraduate engineering degrees. When faced with academic challenges these veterans felt comfortable seeking resources in the forms of information, aid from their community of student peers, and institutional support. Chris felt that any veteran has the potential to exhibit an exemplary work ethic, which can be

paired with knowledge grounded in the location of needed resources. As a veteran of the US Navy, Chris felt he had the ability to find and use knowledge that he needed but did not possess. He explained, “Anybody who's ever served, like, you know how to work hard, how to succeed. You were taught at one point how to find information to get what you need done.” Chris’s reference to his perceived resourcefulness was one aimed at his continued completion of technically rigorous assignments, but other participants like Mark utilized their asset of resourcefulness as an aid in finding broader support for academic success in engineering.

As an undergraduate engineering student at Stanford, Mark found himself facing challenges such as isolation and a rigorous course load that were unique to him. However, he was able to face these challenges by using academic support structures that were available to all undergraduate students. He felt that he used his resourcefulness in finding and using these resources, which he believed most students did not take the time to locate.

I don't know how many other undergraduates are truly taking advantage of all of their resources...It seems like there's just so many, so many resources that go under used and they fly under the radar. No one's really heard of that, you know? You just have to kind of catch on via word of mouth, but I try to take advantage of every resource possible...Not being afraid to reach out and kind of make myself more vulnerable to take advantage of resources when I need them. – Mark

Mark did find himself feeling vulnerable when he sought tutoring aid to bridge gaps in his knowledge but found that the assistance was more valuable than brief instances of self-consciousness. The continued use of his resourcefulness aided Mark as he approached the final semester of his engineering program. He was planning to pursue

doctoral studies and reported that his assets gained from military experiences were what drove his successes on a daily basis.

Mission Completion Driven by Prioritization and Perspective

Participants commonly referenced a mindset that was grounded in mission completion. Many participants reflected upon their military deployments and how those life-threatening experiences afforded them a broader perspective by which they could measure the weight of challenges and the consequences of potential failures. This asset of broader perspective also afforded them a sense of importance or prioritization surrounding aspects of their academic, professional, and personal lives. This sense of importance was a key factor toward mission success because it worked in parallel with the goal-orientation and exemplary work ethic of veterans as they faced challenges in engineering.

For many of these participants, transitioning from an environment of life-threatening combat to one of engineering challenges has led to a redefining of mission completion. As opposed to survival or avoiding serious injury, these redefined missions now relate to academic and professional successes in engineering. The participants related that they must be able to adapt to this new mission if they are to complete it; a task for which many of them felt well-suited. They were adapting to these new engineering challenges with experientially learned military assets such as goal-orientation, a broader perspective, prioritization of tasks, time management, a sense of urgency, and an exemplary work ethic.

Participants referenced the necessity of gaining and maintaining a goal-oriented mindset while conducting military training and operations. This was an asset that carried over to their time in civilian engineering and aided them in the completion of tasks associated with their engineering goals. Tim asserted that most veterans were conditioned to maintain a focus on their goals and objectives. This is an asset that he attributed to the broad community of veterans and active duty military members with which he served. Tim mentioned the value he saw in goal-orientation, stating, “I think in the military...a lot of people are goal or objective-oriented and are keen on taking action as well, and that is something that I have found to be highly valuable.” Participants such as Tim believed that remaining goal-oriented was a key aspect of completing missions and tasks in engineering. A similar outlook was held by Ryan, but he added an additional layer of perspective that he learned during his military training. Maintaining a goal-oriented mindset may aid a veteran in their pursuits, but it may not always lead to the most ideal growth or outcome. Ryan often mentioned that his perspective on overcoming challenges was to keep the goal in mind, while also realizing that eventually all training or challenges will reach a conclusion. Whether in a successful manner or not, all things come to an inevitable end. With that knowledge and experience in hand, Ryan expressed his belief that the end results will be directly tied back to the effort exhibited along the way.

I guess that's probably one of the biggest things. When you go through boot camp or SOI or any training evolution, some really shitty training evolutions I know, okay, well it's only gonna last a month. At the end of this month, it's gonna be worth it. It's gonna be done, it's gonna be over, worth it, and then the work I put into it is the work I get out. That helped me a lot with the whole engineering thing. – Ryan

Ryan came to embrace this perspective of challenges, their discrete timeframes, and the relationship between effort expended and end reward. This combination of perspective and exemplary work ethic was something many participants gained through their basic training and military operations overseas. Having adapted to their new engineering missions, these are assets that participants continued to utilize in independent and group engineering assignments and tasks.

Aligning with this concept of all challenges having an inevitable end date, participants voiced their continued use of a necessary concurrent time management asset. Brian stated that it is not enough to realize that all challenges will eventually come to an end. The time prior to the challenge end is valuable and may provide opportunities for growth and preparation for what may come next. He attributed many of his engineering successes to his management of time. He used time management to schedule almost all aspects of his daily life, which allowed him to operate well as a new engineering student.

Having a rigorous schedule and having things planned out accordingly [in the military]. Like every single day. That actually really helped me to kind of carry that into setting up working hours for my studies when I was an undergraduate engineering student. – Brian

Brian realized he had learned the value of appropriate time management because his days had always been planned for him during his military service. He accessed his memories surrounding military time management strategies and employed them in his student lifestyle. Chris also referenced his time management as being something he learned during his time in the military. Similar to Brian, this asset was of great use to Chris as he pursued his undergraduate engineering degree. Chris mentioned his frustration with other engineering students and his perceptions that they were unable to manage their time

while in teaming situations. He felt that he set himself apart from them with his management of his own and others' time.

Aligning with time management, some participants related that they had gained a sense of urgency that tied directly to their prioritization of engineering tasks and assignments. It became apparent that some of the participants preferred to examine the larger picture of what they were learning and how they were learning it as opposed to maintaining a strong focus on attaining perfect grades. This prioritization led to inform their sense of urgency when facing engineering challenges. Whether the focus was the attainment of knowledge or perfect grades, Lisa believed that the identification and execution of prioritized items was a key aspect of mission completion. Related to this sense of urgency surrounding prioritized goals in undergraduate engineering, Brian focused solely on his academics. He had not enrolled in college for the social aspects, but with the express goal of becoming an engineer, a goal that drove him to work hard and focus on academics.

There's a lot of social aspects of college that I just wasn't interested in when I went back to school. I was just, it was all business when I got there, I wanted to knock out what I wanted to knock out and get going. – Brian

Brian was focused on his academics and their related grades, which had served him well as he pursued his undergraduate engineering degree. Lisa was pursuing a graduate degree in engineering and expressed her interest in the content and achievements that would aid her in engineering pursuits following graduation. She believed that attaining a high grade point average (GPA) without content expertise would be far less valuable than a lower GPA that allowed her to complete internships, focus on professional development, and continue her adjacent work in project management.

But I think like with the veterans like for me I'm like, like, I don't really care about getting perfect score. For it's you know it's sort of, it's just easier to look at the big picture and focus on, "Okay, what do I really need to achieve?" – Lisa

Prior to the completion of this study, both Brian and Lisa completed their academic programs and successfully found career positions in their intended engineering fields.

These assets participants have used to adapt to their engineering missions are all valuable, but an overarching exemplary work ethic was referenced by all of the participants as a necessary tool in tying their assets together for success in engineering. John mentioned his exemplary work ethic that drove him to overcome academic engineering deficits. He continued to work through nights and weekends in order to gain an understanding of engineering concepts that alluded him.

So, if there is something that I'm definitely way behind on the power curve with like I'll try to speed it up on my end, trying to fucking, stay up on the weekends so I can learn about the concepts so that following week we can all be on the same page. – John

Zack had similar experiences in his engineering program. He felt that, due to a lack of content knowledge, he was behind before he even began. He decided to work harder, taking all of the supplemental courses he could fit into his schedule. This allowed him to bridge an educational gap and move forward beyond his past lack of course content knowledge.

I took all the chemistry classes and all those classes over again. And in addition to that, took all the supplementary classes that kind of gave me more time with chemistry because that's one of the weed-out classes for this program. – Zack

John and Zack both believed that their exemplary work ethic afforded them the ability to adapt to their new academic environments, gain a better understanding of the engineering

content they lacked, and complete the milestones within their respective engineering programs.

Many participants related their exemplary work ethic to the concept of military excellence that is driven by an attention to detail. Many of them expressed a belief that exemplary work ethic alone may not be enough if solving engineering problems well is the goal. The participants maintained that hard work must not simply be done but be done well and with attention to the small details of the challenge. Daniel referenced attention to detail as being “one of the bigger things” he learned in the military and that he continued to hold it as a priority when accomplishing engineering assignments. Kristine tied her view on attention to detail directly to veterans’ abilities to use this concept in engineering.

So, that [attention to detail], that's a valuable lesson. I think in engineering it's the same way. Like, there's no halfway point. You either designed correctly and it's going to work, or it's not gonna work. I think that that causes military veterans or military, I guess active duty, to be really cognizant of doing things to standard –
Kristine

Every detail, small and large, must be taken into consideration so that the final product is delivered in an excellent manner. All of these Funds of Knowledge provided these veterans with valuable tools as they confronted challenges associated with academic and professional engineering pursuits.

Identity Crafting

Within the military there is a strong sense that perceptions are reality; the way you look and carry yourself is tied directly to how good you are at accomplishing your job. Even as this may not always be true, it is a manner of opinion that can be used to build value, both perceived and real, in engineering by crafting an ideal identity. These two

narratives were not exhibited by many of the participants, but it was a prevalent driver for the lifestyles and daily decisions of two participants following their military service. Zack and Mary both believed that societal perceptions may become a reality and they each used this concept to craft their ideal identities. However, even with such a similar outlook on the power of societal perceptions, they utilized Funds of Knowledge within their narratives in quite different ways.

Following the ideology of crafting his own identity by shaping others' perceptions of him, Zack decided to preemptively and continually maintain an image he believed would benefit him as an engineering student, professional, and entrepreneur. Based on his perceived overlap between military values, personal assets, and the characteristics of successful engineers, Zack built a system of self-evaluation through which he was able to model his behavior and monitor his progress related to life goals and the identity he wanted to project. Similarly, Mary used her storytelling ability to craft her identity as the capable engineer that she felt her faculty and employers expected her to be. This served to continue her narrative of perseverance, exemplary work ethic, and engineering competence, while building the confidence she believed they had in her as a veteran. Additionally, through her self-driven exemplary work ethic, she molded herself into the engineer they already believed her to be or hoped she would become.

Zack's Narrative – Creating Perceptions to Build a Reality

Using the concept of perceptions and reality proactively, Zack projected important aspects of his life in a manner that he believed would be perceived by others as a successful reality. He was a member of Marine Special Operations Command

(MARSOC). Aside from combat action, MARSOC was tasked with the training of foreign military allies in unconventional warfare. The techniques that MARSOC utilized in training and wartime needed to appear polished and effective even at times of pressure or distress.

The biggest thing that we were taught in MARSOC is the concept of perception is reality. And that's one of the biggest things that I've learned. That the way that some organization or some group sees you, regardless of if it's real or not, is how they will treat you. They'll modify their behavior based off of what they perceive as your background. It's kind of like a shortcut, a psychological shortcut, that people kind of apply and that's honestly what happens with veterans all the time. – Zack

Having gained an understanding of the concepts surrounding perceptions and reality, Zack came to recognize that this could extend far beyond his time in military service. The nature of these perceptions could have an effect on the treatment and expectations of veterans. More specifically, Zack was concerned that others might immediately assume he was a veteran with characteristics he viewed as negative such as PTSD, depression, or an aggressive behavior.

They perceive you to be somebody with these attributes and these characteristics, but, even if it's real or not, that's how they alter your treatment. Sometimes that actually forces you to change as well...forces you into a box or whatever. – Zack

Even with prior literature showing a pronounced veteran presence in the STEM field, that was not Zack's experience. Zack was familiar with working with other veterans and initially felt uncomfortable when he learned that there were only a few veterans in his engineering program. Because he felt underrepresented and recognized some of the negative societal perceptions of veterans, Zack decided to use the concept of perceptions becoming reality as he progressed through his engineering degree. He portrayed himself

in a manner that he believed to be perceived by others as a successful engineer and entrepreneur.

There's not a lot of veteran representation in the STEM community. I've learned and I've kind of started using that my entire way through. I like to kind of get a breadth of different experiences, rather than just hyper-focus on one. I think the perception that people have [has] not warped but altered in my favor where I'm controlling it. – Zack

Zack has a background in business but tries to keep his ventures rooted in the STEM field. However, he took calculated steps to stay well-rounded and incorporate his military experiences into whatever reality he hoped others would perceive him to be. This helped him to continue his entrepreneurial pursuits in engineering, while providing him with a more relatable persona outside of stereotypes associated with engineers entrenched in technical rigor and veterans that struggle to relate to civilians.

I do a lot of business stuff and I kind of keep to my STEM ventures...I try to balance everything out. I leverage a lot of the other skills that I have, especially military experience and special operations experience, and I kind of leverage all of those to build a profile. People perceive me as this individual that's a little bit different from what they're used to and relate to on some level, but like also has experiences that I can relate to other large groups of individuals. I think that's like one of the biggest lessons I learned from MARSOC. Perceptions and reality and how to kind of navigate through a complicated social scene...navigate and adapt because that was a lot of our missions. – Zack

To maintain the reality that Zack preferred others see in him he developed a system through which he regularly evaluated himself. His metric was based on the five traits he perceived to be associated with success in life: intellect, military, adventurous fearlessness, financial stability, and networking.

I try to develop in five different ways. I have this PowerPoint outline of my values and where I want other people to perceive of me. These [are] things I can change and kind of develop into to have a certain image. So, the image is very, very important. Regardless, of the position I'm trying to go for, I'm really trying to

have a certain style of image that really works with a certain...a certain image for that and very, very cross diverse. – Zack

Zack's development metric was comprised of the five aspects, which he did not seek to be a master of, but simply to remain above average. This afforded him an image that, when measured and maintained, would be perceived by other as multidisciplinary; overlapping across engineering, business, and providing him with many aspects that are relatable for people that may become interested in supporting his entrepreneurial endeavors.

Embracing the concept associated with perceptions potentially becoming reality facilitated Zack's successful transition from active duty military member, through his undergraduate engineering degree, and to PhD student and innovative business entrepreneur.

Because of the fact that I bring such a large amount of experience and a lot of breath of experience I know how to navigate complicated social scenes. So, I would say that perception's reality has been integral in everything I've been doing since I got out and building that background, building what others see of me and so forth. And it's been paying off quite well in my case. – Zack

Zack's social navigation began with joining a fraternity of like-minded academics.

Utilizing his understanding of others' perceptions forming his reality, Zack was able to continue building the background that he wanted others to see. He used his experiences as a military leader to become a leader in the fraternity, which helped him to more easily navigate other social situations like managing confrontation, building a beneficial network, and fundraising for his entrepreneurial pursuits.

Mary's Narrative – Building a Reality to Meet Preconceived Perceptions

During Mary's time in the US Navy, she learned how powerful shared experiences and storytelling can be. She used stories to make connections with others through humor, humility, adventure, and as a vehicle to convey assets that she would not otherwise be able to easily work into a conversation. Mary found that her stories make her more relatable to people that she believed have very little in common with her.

Selling myself, man. I sell the story... So, I was very cognizant that I'm talking to these guys usually white men 20 years my senior may have not, may have been in the military, may have not, you know, either way, they dig it. – Mary

Along with the personal connections stories helped her to create, Mary relayed stories that further highlighted what she referred to as her brand; a dynamic picture of her capabilities comprised of her military and technical experience, her ability to troubleshoot, problem solving expertise, and the fact that she consistently remains calm and task-effective under pressure.

So, I always be conscious to weave in a tale related to my experience at some point. Right. I did something cool with the with the CHT [collection, holding, and transfer] tanks in Sardinia, you know, like that's a shit tank, but I can make it sound good. I can relate that to my troubleshooting and my how I can handle pressure, you know, I would weave this funny story. So not only am I weaving in the military, but I'm weaving in something that they won't forget. So, the military experience allowed me to be a little bit unforgettable. – Mary

More specifically, an example of a story she might tell to highlight her problem-solving skills and ability to work under pressure, while showcasing humility and humanizing herself through the humor of the situation is by referencing dangerous, yet memorable, experiences from her time serving in the Navy.

I was working on a crane, on a floating crane. I was working on it for a while and it was horrible. It was from World War II... We had to at some point, like recertify it so we had to pull all the cables off and re-grease all the cables on this damn

thing. And there's me. I'm a junior Third Class...We all get dressed up in those white poofy suits right over our coveralls. And we're playing with grease, I'm greased like I'm a seal. I'm like a greased seal and there's a giant hole, a pit in the bowels. We're calling up to the head to start running the crane. You know, we have to run the crane very slowly so we could at least get the grease on it and we're sitting there on the U-hook [waiting]. Something runs into the side of the crane as we're floating. I think the tide came in, or somebody was coming into to the port...I slip right off the U-hook into the hole and to the very bottom of it. So, I'm in the hole of the crane. There's no ladders. I'm not hurt. I fell in a big pile of grease. I fell into like a mountain of grease, so I am even greasier than before. I am literally stuck 10 feet below deck. I can see the hole. There's no ladders, nothing. And we don't have anything. There's no movable ladders to get me out of the hole. So, it was it was really quite an experience. We actually had to have people kind of link up on each other to create a human ladder for me to walk up on up their butts. I was grabbing their butts and sliding down again and then getting out. Yeah. That was, that was my experience. I would relate that to a leadership skill other than an epic fail, like a big fail. – Mary

One of the main priorities in a story such as this previous one is to be memorable. She mentioned often that stories are only as good as they are memorable. Once forgotten, the message of the story may remain for a certain period of time, but they hold lasting value when the audience enjoyed them, and the narrative continued.

Currently Mary is a PhD candidate. She described how she might also relate the same story to one of perseverance, a mission first attitude, and her ability to work until the job is complete.

Oh, yeah, this is something I teach my students now as an instructor. Perseverance, right? Even though I fell in a hole of grease, I still continue on to get the job done. That is something that my bosses have always said is a benefit to them. Even if I screwed up, I break it, I blow it up, or I don't know what I'm doing, I won't quit until we're done. I'll figure it out. Just to get the job done. I'm a mission-first kind of person, and I think the military enhanced that in me. – Mary

Mary used her stories and the concept related to perceptions being believed to be reality to bolster other peoples' images of herself. She found that civilians view her as extraordinary because of her military experience.

Often when faced with an engineering task that Mary has no experience completing, she found herself surrounded by superiors that assumed she could accomplish it. “I had no training at all and had to figure it out as I went, but because ‘you were in the military. You can do anything’, [her bosses assumed]. Yeah, okay.” To continue this narrative of military veterans and their ability to “do anything” Mary would find ways adapt and overcome challenges she was facing. She would train herself and learn the knowledge required for the tasks at hand. Additionally, she referenced her ability to communicate these new skillsets and technical knowledge to non-technical people. She used her exemplary work ethic and perseverance to become the engineer that her supervisors expected she would be.

I'll find a book I guess...to learn. I feel like that enhanced my career. What would have taken 10 years took me five. Right, and as far as experience, I have the ability to translate that to people and use it as a selling point of my skill set. I had to become really good really fast. Working in contract outfits, I was one of two engineers. Right? So, that's it. You don't have a room full of engineers, where there's 15 people working with you. You had to do it all. – Mary

She gained a sense of humility and the ability to laugh at herself during military service. She believed these attributes to have been advantageous in teaming situations, whether she was the leader or simply a member of the team. This is something that continued to serve her well in professional engineering teams. As a corporate engineer, she used humility to relate to the engineering technicians. Having been a technician in the military, Mary used those experiences to circumvent stereotypically negative perceptions of engineers that some technicians believe to be true, which formed a new reality; one in which she was viewed as a respected member of the team.

I think being able to laugh at yourself makes the team work better. That's what I found. And that's what I learned. I'm sure the military is where it started. I'm

positive it did. And then I just was able to, as a team lead in the civilian world, use that more to make me part of the team. I would be the corporate engineer coming out to the field to work with all the techs, you know? I was a tech and, you know, I have an idea how to do that type of work. That type of humility helped. I want them to be open to my direction, especially as somebody coming in trying to lead. – Mary

Mary felt that her military experience has given her the ability to lead effectively and interact with all levels of people in her academic engineering program. Along with her ability to lead, Mary came to understand the power of storytelling and how to strengthen her leadership potential through the incorporation of stories. Her stories not only bolstered her leadership abilities, but they also worked well in conveying these messages so that others might perceive her as a veteran with assets. When asked what one of the main assets she experientially learned in the military, Mary responded,

My leadership. My managerial style and my influence with subordinates, with folks who are younger than me, or even my fellow peers and my influence in interacting with them...As I'm telling my stories I'm trying to find the roots of those stories. There's a lot of things I could say that the military did for me, and I don't think that they're the typical technical skills. I have to be very verbal and have to be able to iterate those [assets] into something that people want.

One of the greatest gifts that Mary's military experiences afforded her was perseverance, which she highlights as her professional brand.

I think my military experience really just gave me the ability to embrace the suck. Right. You're just able to get through the shit, wake up tomorrow, do it again, and get through it. Honestly, I think that allowed me to persevere after the military. I call it my brand. – Mary

Along with perseverance, Mary felt that, even though she may have the same technical skills as her peers, they may not have the same ability as she to sell themselves as engineering problem solvers. She felt that her ability to “sell her brand” was important for communicating one's strengths, networking, and ultimately elevated her chances for

success within the field of engineering. Mary continued to use storytelling to become the veteran who can do anything that is asked of her with excellence. She felt that the more stories she tells the stronger her brand becomes. Referring to her time in reflection on her brand and how she planned to use storytelling to promote herself in the engineering education world Mary said,

I think the fact that I've actually sat down and thought about it and can talk about it is interesting. I even thought my colleagues might have the same [metaphoric] toolbox. I actually think they do. They just don't know how to dig in and pull that specific one out and talk about this particular tool...They haven't got it in their brain just yet. We're all engineers. We all have to analyze things and think really hard, but rarely do we talk off the cuff...I've actually thought about it and I use it as part of my rebranding. I use that. I sell myself with that and am unique in that regard. And that's what I'm planning on doing I'm working myself up as I tell you these stories. I'm telling other people stories too. I'm practicing so I can just be off the cuff. So, because I'm planning to start really pimping myself out to get it, a professor job. Hopefully, I'll be able to work my way in without a post-doc.

Mary explained that she does not feel unique in her assets surrounding engineering, her toolbox, but that she believes she is better suited than most of her peers to access and take advantage of her assets. She continues to update and disseminate her brand, which she hopes will aid her in her pursuit of becoming a professor.

Due to my time serving in the military, I, Michael, am very familiar with the concept that others' perceptions of you can become the reality that they believe. It is a concept that, when understood and executed appropriately, can be a strong tool for projecting a reality that you believe will provide value for your pursuits. *Creating Perceptions to Build a Reality* aided Zack in his goals to exude success, socialize as a relatable veteran with his non-veteran peers, and fundraising for his entrepreneurial pursuits. Similarly, *Building a Reality to Meet Preconceived Perceptions* helped Mary to build and sell her brand. She was able to connect with engineering professionals she

believed to be far outside of her typical social scope and, as she has grown to meet the expectations she perceives from being seen as a veteran who can “do anything,” Mary has become far more skilled as an engineer. Zack and Mary’s stories provide an abundance of evidence to support the idea that others may believe of us what they perceive; a belief that may not always be correct, but one that can be used as a powerful asset.

Conclusion

The findings of this chapter presented 10 veterans’ Funds of Knowledge as they related to their associated emergent themes. The first theme, Effective Teaming in Engineering, was comprised of *Interpersonal Communication Spanning the Team Environment*, *The Usefulness of Military Values Within Engineering Teams*, *Knowing How and When to Lead*, *Exemplary Work Ethic*, and *Building Beneficial Networks*. The second theme, Adapting to Overcome Challenges, was comprised of *Navigation Systems Through Organizational Learning*, *Managing Resources to Overcome Challenges*, *Mission Completion Driven by Prioritization and Perspective*, *Exemplary Work Ethic*, and *Building Beneficial Networks*. An in-depth exploration of two participants, Zack and Mary, was also presented and provided support for a separate concept exhibited only by these two veterans, Identity Crafting. These veterans’ Funds were used to build a reality that the participants’ sought by shaping the impressions of those that perceived them. The alignment between the veterans’ Funds of Knowledge, engineering education, and engineering industry will be further explored in the following chapter.

CHAPTER 5

DISCUSSION

The focus of this study was to better understand the experientially learned military assets that veterans continued to use as engineering students and professionals. Prior literature has found evidence to suggest that veterans are well-suited to engineering education because of their unique assets (Knowles, 1984; Main et al., 2019; Sheppard et al., 2019; Tavernise, 2011). Previous reports and literature have identified traits that are valued highly in engineering education and industry, which include, but are not limited to leadership and project management (ABET, 2018; Brunhaver et al., 2018; Bucciarelli, 2001; National Academy of Engineering, 2004), organizational skills (ABET, 2018; Brunhaver et al., 2018), an ability to work with others in teams and heightend communication (Brunhaver et al., 2018; Bucciarelli, 2001; Davis, Beyerlein, & Davis, 2005; Stockman et al., 2017; Winters et al., 2013), an elevated work ethic (Brunhaver et al., 2018; Winters et al., 2013), and the ability to make sound decisions (Stockman et al., 2017).

Even as many veterans exhibit these traits, there is little evidence to suggest that these assets held by veterans are due to their time in the military. This study sought to address this gap in the literature by identifying assets that participants believe to have been experientially learned during their military service. These veterans' experiences in the military, as students, and industry professionals in engineering varied widely, but there were many similarities across their assets and the Funds of Knowledge developed during this analysis. This chapter further discusses the unique assets that veterans exhibit

as engineering students and professionals, how these assets align with engineering education student outcomes, and the value they provide when compared to sought after characteristics of engineers in industry, while highlighting the impact that a better understanding of these veterans' Funds of Knowledge can have within both engineering education and engineering industry.

Veterans' Funds of Knowledge in Engineering

This study found evidence that supported prior literature surrounding the value veterans provide in engineering and continued to build upon the work of similar studies that identified the unique assets of veterans in engineering (Brawner et al., 2016; Main et al., 2019; Molina & Morse, 2017). There is a strong alignment between prior veteran studies and the findings of this study. However, the goal of this study was not to continue identifying the unique assets of veterans in engineering, but to better understand the unique assets that were developed during military service and further examine how they have been used in engineering. Special care was taken to ensure that these participants' assets and the Funds of Knowledge developed were identified as being experientially learned during military service and not due simply to their age, family obligations, maturity, or other characteristics unrelated to their time in the military.

Veterans as Adult Learners

A reoccurring topic of discussion concerning veterans' assets in engineering is grounded in *Adult Learner Theory* (Knowles, 1984). Using *Adult Learner Theory* researchers have provided evidence that veterans exhibit assets allowing them to excel as students and professionals within STEM fields (Brawner et al., 2016; Knowles, 1984;

Molina & Morse, 2017). These assets include a heightened work ethic, excitement to learn new things, and an ability to communicate effectively. The findings of this study support previous conclusions that veterans do utilize these assets of *adult learners*. The participants have a more defined concept of themselves and they had similar experiences when compared to other adult learners. Additionally, they displayed a motivation, eagerness, and orientation toward lifelong learning. However, building on previous studies where veterans' assets were attributed potentially to their demographics associated with being *adult learners* (Brawner et al., 2016; Molina & Morse, 2017), participants in this study explained their beliefs that their unique assets were not due to their age, but to their military service. Similar to the traits directly related to *Adult Learner Theory*, this study presented evidence that reinforced the participants' drive to succeed, valuable experiences, engagement toward learning, and task-orientation, which are all assets reported in previous studies (Blaauw-Hara, 2016; Kenner & Weinerman, 2011).

Veterans are *adult learners* and exhibit the assets of this community, but evidence provided in this study suggests that they hold assets unique even within the *adult learner* community. Prior literature cited the drive and motivation of *adult learners* (Brawner et al., 2016; Knowles, 1984; Molina & Morse, 2017), which aligns well with the veterans' Fund of Knowledge *Exemplary Work Ethic*, but this study has uncovered many other Funds that are not discussed in previous *adult learner* studies. *Interpersonal Communication Spanning the Team Environment, Building Beneficial Networks, The Usefulness of Military Values Within Engineering Teams, and Managing Resources to*

Overcome Challenges are Funds of Knowledge exhibited by the participants of this study. These results expand on prior literature by identifying a clear delineation between *adult learners* and veterans in engineering.

Building on Prior Veteran Literature

Similar to the alignments between this study and previous adult learner work, there were many unsurprising similarities and agreement with previous studies that focused on veterans in engineering education and industry. More interestingly, there was an abundance of evidence from this study that built on prior work or presented in slight contrast to previous findings.

Leadership. It was unsurprising to find that the participants felt at ease engaging in situations that needed leadership. The ability to lead and the drive to be a good leader are prevalent traits identified in prior literature surrounding veterans in engineering (Main et al., 2019). Along with teaming, a heightened work ethic, and effective communication found in prior studies, leadership was referred to as a prominent asset of student veterans (Brawner et al., 2016; Main et al., 2016; Molina & Morse, 2017). However, with some participants in past studies unclear as to how they gained their abilities to lead (Brawner et al., 2016), this study provided an opportunity for future research to examine the intersectional effects of age, gender, and maturity on leadership. This study served to fill the gap of uncertainty surrounding veterans' assets that may have been developed during military service and those definitively experientially learned during military service.

All of the participants discussed their belief that their understanding of good leadership and abilities to lead were learned while they served in the military. Mirroring

an aspect of Main et al. (2019), many of the participants expressed a motivation to experience good leadership and be good leaders in their engineering studies when needed. However, they also explained that they were not typically interested in being the designated leader of their teams. Prior research also referenced the testing of leadership abilities that most veterans experienced during their time in service, which has provided them with the skills and motivation to lead (Main et al., 2016, 2019; Rabb et al., 2017). While this study found that the majority of participants believed their high self-efficacy in leading others had been shaped by their military experiences and formed the *Knowing How and When to Lead* Fund of Knowledge, few were excited to lead unless confronted with a scenario where poor leadership could adversely affect their goals. Often, a scenario of this nature referred to teaming experiences in engineering education. Faced with a teaming environment devoid of appropriate leadership, many participants then found a higher motivation to lead the team to success.

Teaming and Communication. Along with an ability to lead in an effective manner the participants explained their ease working in multidisciplinary teams. This finding reinforced a previous pilot study that found veterans had a high self-efficacy surround their abilities to work within their engineering teams (Sheppard et al., 2019). Findings of the pilot study and additional prior literature also aligned with the veterans' Fund of Knowledge *Interpersonal Communication Spanning the Team Environment*. This study provided evidence of this Fund as participants continued referencing their abilities to communicate well with student peers, faculty in engineering education, and engineering industry professionals (Brawner et al., 2016; Main et al., 2016, 2019;

Sheppard et al., 2019). Task completion and a task-oriented mindset, assets embedded in the *Mission Completion Driven by Prioritization and Perspective* veterans' Fund of Knowledge, were also found to play a role in veterans' abilities to work well within their engineering teams (Kenner & Weinerman, 2011). Parallel to the other veterans' Funds of Knowledge, this ability to work within teams, communicate, and perform tasks with efficiency was referenced by participants as having been experientially learned through their military service.

Work Ethic and World Perspective. This study also presented evidence in agreement with the findings of Blaauw-Hara (2016) and Cate (2014). These previous studies explored the value that veterans bring with them into engineering. Veterans participating in their studies exhibited elevated student abilities in the forms of work ethic, the ability to organize content and task within their teams, a drive for success, and a broad "world perspective." A review of the veterans' Funds of Knowledge, *Exemplary Work Ethic, Managing Resources to Overcome Challenges, and Mission Completion Driven by Prioritization and Perspective*, provided a direct alignment with the work of Blaauw-Hara (2016) and Cate (2014). These veterans' Funds Knowledge also align with the findings of Main et al (2016), whose work found that student veterans had organizational skills within their teams and individual engineering endeavors that set them apart from many of the traditional students, and Kenner and Weinerman (2011), who found that veterans exhibited an elevated drive for success and the ability to utilize efficient work practices when faced with academic challenges.

There are strong correlations between the veterans' Funds of Knowledge evidenced in this study and the veterans' assets identified in prior literature. However, all of the participants' assets identified in this work are tied directly to their military experiences. This provides an exciting opportunity to further explore the veterans' Funds of Knowledge and gain a better understanding of the value they bring to engineering education and engineering industry.

Veterans' Funds of Knowledge Aligning With Engineering Education

ABET, the accrediting body for engineering programs and engineering technology, assesses student outcomes (ABET, 2018). This study found a strong alignment between the veterans' Funds of Knowledge and the student outcomes criteria, which are displayed in Table 5. Prior studies have found similar results surrounding veterans' abilities to communicate effectively, teaming, and leadership. As these outcomes are assessed by ABET, recruiting students that already exhibit them may allow for more time to focus on the technical aspects of engineering. It is important to note that these outcomes were present prior to the completion of these veterans' engineering programs. Therefore, many veterans are potential engineering students that already exhibit outcome measures used to assess the credibility of engineering programs.

| Table 5 | |
|--|---|
| <i>Veterans' Funds of Knowledge and ABET Student Outcomes</i> | |
| Funds of Knowledge | ABET Student Outcomes |
| <i>Interpersonal Communication Spanning the Team Environment</i> | Outcome 3: An ability to communicate effectively with a range of audiences |
| <i>Building Beneficial Networks</i> | |
| <i>Mission Completion Driven by Prioritization and Perspective</i> | Outcome 4: An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts |
| <i>The Usefulness of Military Values Within Engineering Teams</i> | |
| <i>Knowing How and When to Lead</i> | Outcome 5: An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives |
| <i>Mission Completion Driven by Prioritization and Perspective</i> | |
| <i>Managing Resources to Overcome Challenges</i> | Outcome 7: An ability to acquire and apply new knowledge as needed, using appropriate learning strategies |

An Ability to Communicate Effectively With a Range of Audiences

Interpersonal Communication Spanning the Team Environment and *Building Beneficial Networks* were veterans' Funds of Knowledge directly related to the student outcome, "An ability to communicate effectively with a range of audiences." Whether in a combat scenario or not, communication is an essential skill in the military, and it is one for which the majority of participants held high self-efficacy. Participants explained that the ability to communicate well was a skill that was honed in the military and further used in engineering. Along with an elevated self-efficacy in their abilities to communicate with peers, some participants felt that they communicate effectively with people they viewed as having more power than themselves, such as faculty and staff.

Some participants explained they have the ability to effectively communicate through public speaking and during the presentation of their engineering projects, while other participants reflected on their skill at written communication, which they believe to have been established during their military service. Aside from the ABET student outcome assessment, communication is a powerful asset that veterans can use within and for their engineering teams.

An Ability to Recognize Ethical and Professional Responsibilities in Engineering Situations and Make Informed Judgments, Which Must Consider the Impact of Engineering Solutions in Global, Economic, Environmental, and Societal Contexts

Mission Completion Driven by Prioritization and Perspective and *The Usefulness of Military Values Within Engineering Teams* were veterans' Funds of Knowledge that were aligned with the student outcome, "An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts." The participants explained that their professional manner and their ability to understand professional responsibilities was due to their belief in core values of the military and the self-discipline they gained through extensive training and operations. Another asset that was gained through their training and operations was a broad, often global, perspective. This broader perspective is an asset that many of the participants held in high regard and it often provided context for the informed decision making of engineering solutions. These veterans' perspectives and professional demeanor have also been of use in their engineering teams. They afford them the experience needed to plan,

prioritize, and execute engineering project tasks, while often providing real-world experience with which they can weigh the impact of engineering solutions.

An Ability to Function Effectively on a Team Whose Members Together Provide Leadership, Create a Collaborative and Inclusive Environment, Establish Goals, Plan Tasks, and Meet Objectives

Participants discussed their abilities to function within a teaming environment and provide effective leadership. Bolstered by the veterans' Funds of Knowledge, *Knowing How and When to Lead* and *Mission Completion Driven by Prioritization and Perspective*, the emergent theme of Effective Teaming in Engineering is directly aligned with the student outcome, "An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives." The participants provided evidence of their teaming, leadership, goal-oriented mindset, prioritization, time management, and attention to detail. These are all assets that participants utilized in their engineering education environments to build stronger student teams, determine engineering solutions, and aid their student peers through effective leadership and team management.

An Ability to Acquire and Apply New Knowledge As Needed, Using Appropriate Learning Strategies

Many of the participants referenced their ability to adapt to new and unique challenges. More specifically, participants shared a belief that entrepreneurship, resourcefulness, adaptation, and the ability to learn information quickly were particularly important assets that aided them as they overcame challenges in the military, engineering

education, and engineering industry. “An ability to acquire and apply new knowledge as needed, using appropriate learning strategies” is a student outcome found within the emergent theme of Adapting to Overcome Challenges and is more specifically aligned with the veterans’ Fund of Knowledge *Managing Resources to Overcome Challenges*. There was also evidence of alignment with Individual Adaptability Theory (Ployhart & Bliese, 2006), as participants displayed assets such as an understanding of how to learn new things quickly, how to procure resources to aid in adaptation, and a willingness to change in order to accomplish a new task. This Fund of Knowledge was prevalent in the veterans facing new transitional, academic, and social challenges in engineering education, which also brought value to their student engineering teams.

Veterans’ Funds of Knowledge Aligning With Engineering Industry

The Engineer of 2020 (National Academy of Engineering, 2004) and Boeing’s Desired Attributes of an Engineer (Boeing, 2020) are two publications within which the desired outcomes of engineers entering industry are outlined. While some attributes are broad (e.g., Communication), others are quite specific (e.g., A profound understanding of the importance of teamwork) and there is a notable overlap between *The Engineer of 2020* attributes and those described by Boeing. These sought-after engineering attributes serve as potential highlights of what industry is looking for in their engineering hires. This study found a strong alignment between the veterans’ Funds of Knowledge and the desired attributes of engineers in industry, which are displayed in Table 6.

As these attributes have been referenced as goals for graduating engineers and appear to be sought after in engineering industry, it is important to recognize that many of

the participants exhibit these Funds of Knowledge and their parallel engineering attributes. These desired attributes were not gained through their engineering curriculum, but through their military service, which provides evidence to support the idea that many veterans bring value to the engineering companies that hire them. A focus on recruiting veterans who are engineers may provide companies with a reliable source for the attributes they are seeking in employees.

| Table 6 <i>Veterans' Funds of Knowledge and Desired Attributes of Engineers</i> | | |
|--|--|---|
| Funds of Knowledge | Desired Attributes of Engineers in Industry | |
| | Engineer of 2020 | Boeing's Desired Attributes of an Engineer |
| <i>Interpersonal Communication Spanning the Team Environment</i> | Communication | Good communication skills |
| <i>Building Beneficial Networks</i> | | |
| <i>Knowing How and When to Lead</i> | The ability to lead | A profound understanding of the importance of teamwork |
| <i>The Usefulness of Military Values Within Engineering Teams</i> | Professionalism | - |
| <i>Managing Resources to Overcome Challenges</i> | Dynamism, agility, resilience, and flexibility | Flexibility – The ability and self-confidence to adapt to rapid or major change |
| <i>Mission Completion Driven by Prioritization and Perspective</i> | The drive to be lifelong learners | Curiosity and a desire to learn for life |
| <i>Exemplary Work Ethic</i> | | |

Communication and Good Communication Skills

The veterans' Funds of Knowledge *Interpersonal Communication Spanning the Team Environment* and *Building Beneficial Networks* serve to satisfy similar desired

attributes of engineers in industry. “Communication” (National Academy of Engineering, 2004, p. 55) and “Good communication skills” (Boeing, 2020) are both present within these Funds of Knowledge and were exemplarily exhibited by many of the participants. They attributed their understanding of proper communication and a high level of self-efficacy surrounding their ability to communicate as being traits they had acquired during military service. The need for clear and concise communication has a direct translation into the participants’ abilities to communicate effectively in the engineering industry.

The Ability to Lead and a Profound Understanding of the Importance of Teamwork

Knowing How and When to Lead is a Fund of Knowledge that is also present in two desired attributes of engineers in industry, “The ability to lead” (National Academy of Engineering, 2004, p. 56) and “A profound understanding of the importance of teamwork” (Boeing, 2020). As evidenced in the findings of this study, all of the participants gained a great understanding of good leadership, how to lead, when leadership was needed, and the importance of establishing functional teams. Even when the participants may not want to be designated as the leaders of their teams, they saw the need for strong leadership to drive their teams toward success. This continued as they moved from military teams to those in the engineering industry.

Professionalism

The Usefulness of Military Values Within Engineering Teams is one of the veterans’ Funds of Knowledge that translated to the desired engineering attribute of “Professionalism” (National Academy of Engineering, 2004, p. 56). Participants explained that their military values provided them with a professional demeanor that they

believed is necessary in the engineering industry. Some participants also expressed a belief that their direct supervisors not only appreciated their professionalism but expected it because of their veteran status.

Dynamism, Agility, Resilience, and Flexibility – The Ability and Self-Confidence to Adapt to Rapid or Major Change

Another pair of overlapping engineering attributes are “Dynamism, agility, resilience, and flexibility” (National Academy of Engineering, 2004, p. 56) and “Flexibility – The ability and self-confidence to adapt to rapid or major change” (Boeing, 2020). These align well with the veterans’ Fund of Knowledge *Managing Resources to Overcome Challenges* and the emergent theme of Adapting to Overcome Challenges, which explored the nature of the participants’ successes as they faced challenges associated with their military service. *Managing Resources to Overcome Challenges* continued to be utilized successfully by these participants as they navigated challenges in their specific fields of engineering industry.

The Drive to Be Lifelong Learners, Curiosity, and a Desire to Learn for Life

Participants stated that their prior engineering knowledge was not always sufficient in overcoming many of the rigorous problems they faced in their engineering industry positions. Aligning with “The drive to be lifelong learners” (National Academy of Engineering, 2004, p. 56) and “Curiosity and a desire to learn for life” (Boeing, 2020), these participants utilized *Mission Completion Driven by Prioritization and Perspective* and *Exemplary Work Ethic*. This lifelong learning aided them as they sought new

knowledge and took the initiative to become trained in new tasks, which were both paramount in surmounting the challenges they faced in their engineering careers.

Implications

The findings in this study, coupled with prior literature on veterans in engineering, provides a unique opportunity to better understand veterans' Funds of Knowledge as they relate to the value they bring to engineering education and the engineering industry. Aside from the value that veterans bring with them to engineering education and engineering industry, there are numerous individuals who can benefit through interactions with veterans and the utilization of veterans' Funds of Knowledge. Additionally, this study presents the potential value that engineering education and engineering industry may gain from adopting common military practices.

Engineering Education

Professors who have gained a better understanding of veterans' Funds of Knowledge and experiences associated with participants of this study may utilize this information in a few ways. Understanding that practices can be transferred or learned through interaction, there is an opportunity to share these veterans' Funds of Knowledge with their student peers. Spreading veterans across multiple engineering teams will provide value to those teammates. There is potential for the veterans' assets such as, but not limited to, teaming, leadership, and professionalism to aid the teams as they progress toward academic success and they may be adopted by the non-veteran students. Alternatively, this study provided evidence to support the existence of an intangible community of veterans. Many of the participants explained that they were more

comfortable working with other veterans who they believed had fostered a community of self-reliance, support, and collaborative entrepreneurship. Providing veterans with the option to work with other veterans in the classroom, as opposed to assigning teams, may facilitate a sense of community and inclusion for the veterans who are seeking an environment of this nature. These veterans' Funds of Knowledge have the potential to transfer to other student peers and may create a more inclusive classroom environment for student veterans. There may also be added value in the classroom if faculty were to examine and incorporate the structure of military training and routine. Much of military training is built on a competency-based design, which may align well with competency-based engineering curricula (Dowling, 2006; Earnest, 2005), where accomplishments and proof of competencies allow the military members to continue forward with more advanced training evolutions. This practical structure can be implemented to allow for the same progression of students as they provide proof of the competency in various engineering topics. Students requiring more time to accomplish basic competencies could be provided it while other students, once proficient on these basic competencies, could continue forward to focus on more difficult concepts.

Administrators and policymakers can bolster the faculty's utilization of veterans and their Funds of Knowledge in the classroom by gaining an understanding of veterans' experiences and the unique challenges that they may face as engineering students. Service-connected disabilities are prevalent in veterans (U.S. Department of Veterans Affairs, 2018) and may present them with unique challenges as they transition into engineering programs (Ackerman et al., 2009; Burnett & Segoria, 2009; Jakupcak et al.,

2009; Ostovary & Daprich, 2011; Sheppard et al., 2019). With an aim of increased recruitment and retention of student veterans, there must be a good understanding of support structures and policies that many of these students may require. This understanding of veterans and the implementation of appropriate support for them may be crucial as administrators seek to retain student veterans who exhibit unique Funds of Knowledge related to engineering education.

Engineering Industry

Similar to the value that veterans bring with them into engineering education, this study provided evidence in agreement with prior literature (Knutson, 2015) that veterans exhibit many sought after traits associated with engineering industry. Business owners and managers may be able to hire capable engineers while decreasing the time involved in the new hire process by focusing on applicants who are veterans. The participants of this study displayed assets that aligned with attributes that are valued in the engineering industry (Boeing, 2020; National Academy of Engineering, 2004). They exhibited attributes of leadership, communication, teaming, heightened work ethic, a focus on completing the mission, and a mindset of attention to detail are all in alignment with engineering industry needs. Seeking and hiring veterans into engineering positions may lead to the acquisition of engineers that are motivated self-starters and are able to work on projects independently and in teams. This study provided narratives that detailed times when the participants were able to overcome engineering challenges without additional training or a company investment, which further supports the hiring of veterans as engineers.

Beyond recruiting and hiring veterans into engineering roles, there may be an opportunity to develop a unique form of promotion and pay-scale increases that parallels the military promotion schedule. The process through which one attains a higher rank and promotion in the military is quite straight forward. It is a system of milestones and measures, which allow for a straightforward pathway to pay scale increases and promotions. This concept of promotion could easily be incorporated into more industry structures to provide promotion transparency and ensure that engineers are aware of the professional development needed to progress toward the next level of their engineering position.

With a good understanding of the value veterans bring into the engineering industry, recruiters may attain higher placement rates if they have a focus on recruiting veterans for their staffing clients. This scenario creates a mutually beneficial situation in which the recruiters can gain acclaim by providing capable staff, engineering companies hire engineers that exhibit many of the desired attributes within the field, and more capable veterans become gainfully employed as engineers.

Future Work

Future work could reflect more specific interests borne out of the data for this study. There are opportunities for further investigation surrounding the experiences of combat veterans, military personnel and veterans who experienced trauma outside of combat, and the potential inequity experienced by women in the military. Additionally, there may be valuable information to be gained in more narrowly scoped studies. This study achieved a high level of variability across demographic characteristics such as

military branch, gender, ethnicity, and age. Potential future studies could focus on a specific demographic characteristic across differing military experiences. Finally, a longitudinal study that followed veterans through their entire time in an engineering program could be used to form a better understanding of the veterans' perspectives, the use of their assets from the military, and highlight the transitions that they continue to experience year to year. Even though there is an abundance of deficit-based work surrounding veterans and their unique challenges, a strength-based approach may be beneficial in both understanding the phenomena of the future work and allowing for a more empowering experience for the participants.

Conclusion

This study has provided evidence to support the concept that experientially learned assets from military service can continue to provide value for veterans engaged in engineering education and the industry of engineering. Veterans explained a myriad of engineering situations in which they continued to utilize their military assets. These assets, which generated a set of veterans' Funds of Knowledge can be useful not only for the participants that exhibited them, but also the engineering programs that recruited them, the engineering faculty, and businesses that eventually employed them. Gaining a better understanding of the veterans' experiences and their Funds of Knowledge can provide a unique form of value in engineering education and engineering industry.

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APPENDIX A
DEMOGRAPHICS SURVEY

Demographics Survey

Thank you for your interest in my study!

By proceeding with the survey, you are agreeing to participate in this study.

1. Are you a military veteran that is, or was, an engineering student?

Yes

No



If No, survey skips to the end and is complete.

2. What college or university did you attend for your engineering education?

Academic Institution _____

3. Please provide your contact information:

Last Name: _____

First Name: _____

E-mail Address: _____

Phone Number _____

4. Preferred form of contact:

Text Message

Email

5. Please enter your age in years

Age _____

6. Please indicate your gender (check all that apply)

Female

Male

Other _____

Prefer not to answer

7. Please indicate your ethnicity (check all that apply)

White

Black or African American

American Indian or Alaska Native

Asian

Native Hawaiian or Pacific Islander

Hispanic or Latino

White, not Hispanic or Latino

Prefer not to answer

Other _____

8. Branch of Military Service (check all that apply)

Air Force

Army

Coast Guard

Marine Corps

Navy

9. During Active Duty

How long were you enlisted in the military? _____

What was/were your military job(s) during your time in service? _____

10. Were you involved in combat action?

Yes

No

Prefer not to answer

11. Do you receive or are you eligible to receive service-connected compensation from the Veteran's Association?

Yes

No

Prefer not to answer



If Yes, survey continues to question 11.1

If No or Prefer not to answer, survey skips to question 12

11.1 Do you receive or are you eligible to receive compensation rated at 30% or more?

Yes

No

12. Highest Level of Education Prior to Military Service:

High School Diploma or Equivalent

Some Community College

Associates Degree

Some University/College

Bachelor's Degree

Master's Degree

PhD Earned

13. How much time passed between your discharge date and entry into your engineering program?

Years or months since military discharge _____

- End of Survey -

APPENDIX B

RESEARCH INFORMATION SHEET

STUDY TITLE:

Discovering the Unique Strategies of Military Members and Veterans in Engineering: A Narrative Strengths-Based Approach to Qualitative Research

INVESTIGATORS:

Michael Sheppard
Dr. Nadia Kellam

WHY AM I BEING INVITED TO TAKE PART IN A RESEARCH STUDY?

We invite you to take part in a research study because you are a veteran that has decided to pursue an engineering degree, or you are a veteran employed as a professional engineer.

WHY IS THIS WORK BEING DONE?

The purpose of this study is to identify the assets and strengths of veterans, experientially learned during military service, to better understand the development of these strengths and how they are still utilized.

HOW LONG WILL THE RESEARCH LAST?

We expect that individuals will spend 45-60 minutes participating in an interview.

HOW MANY PEOPLE WILL BE STUDIED?

We expect 8-10 people will participate in this research study.

HOW WILL PARTICIPANTS BE SELECTED?

All potential participants will complete a demographic survey. This survey will identify the existence or lack of traits that are particular for the population sample (e.g. age, gender, branch of the military, etc.).

WHAT HAPPENS IF I SAY YES, AND I AM SELECTED FOR THIS RESEARCH?

We will meet in-person or through the use of digital communication for an interview lasting approximately 45-60 minutes. You may be contacted again via email within a week of the interview with clarifying or follow up questions based on responses given in the interview.

WHAT HAPPENS IF I SAY YES, BUT I CHANGE MY MIND LATER?

You can leave the research at any time. It will not be held against you.

IS THERE ANY WAY BEING IN THIS STUDY COULD BE BAD FOR ME?

The risks and discomfort associated with participation in this study are no greater than those ordinarily encountered in daily life.

WILL BEING IN THIS STUDY HELP ME IN ANY WAY?

We cannot promise any benefits to you or others from your taking part in this research. However, possible benefits include greater insights into your strengths and experiences.

WHAT HAPPENS TO THE INFORMATION COLLECTED FOR THE RESEARCH?

Contact information including first and last names will be collected as part of the demographic screening survey to set up interviews. This contact information will be deleted from the data and discarded once the interview is scheduled. Participants will be assigned pseudonyms instead. All data gathered during this study, including the demographic survey for participant recruiting, will be stored in a password-protected file on a password protected computer. Only the research team will have access to this data, and it will be retained for no more than two years. All members of the research team have been trained in data security and confidentiality. We are also asking your permission to audio record the interview. Only the research team will have access to the recordings. The recordings will be deleted immediately after being transcribed and any published quotes will be anonymous. To protect your identity, please refrain from using names or other identifying information during the interview. Let me know if, at any time, you do not want to be recorded and I will stop.

WHO CAN I TALK TO?

If you have questions, concerns, or complaints, talk to the research team at michael.sheppard@asu.edu or contact Dr. Nadia Kellam, the PI, at nadian.kellam@asu.edu.

This research has been reviewed and approved by the Social Behavioral IRB. You may talk to them at (480) 965-6788 or by email at research.integrity@asu.edu if:

- Your questions, concerns, or complaints are not being answered by the research team.
- You cannot reach the research team.
- You want to talk to someone besides the research team.
- You have questions about your rights as a research participant.
- You want to get information or provide input about this research.

APPENDIX C
INTERVIEW PROTOCOL

* Use zoom in advance to connect with the participant, share some experiences, clarify the study, emphasize the interest in their stories, and schedule the actual interview. This can also serve to provide the participant with some time to reflect on their experiences.

Purpose of the studies (for zoom conversation):

I'm building a body of work that highlights the transition from active-duty military member to engineering student or professional engineer. I'm interested in learning more about the unique skills, strategies, and military experiences that make veterans excellent students and professionals.

Starting reminders & explanation of interview protocol as needed:

- Interview will be recorded. We can stop at any time and you can skip questions if you don't want to answer them
- I use pseudonyms for identification.
- Any questions before we begin?

Narrative opening:

I'm interested in hearing your story of how you got to where you are today as an engineering student [or engineer]. I'd like to learn more about your transition of leaving the military and beginning [continuing] your time in engineering.

[Active listening]

I'm also interested in the unique strengths and skills you may have learned during military service. What are some of them and how do you use them today?

[If they cannot think of anything share some findings from literature and previous interviews]

[Following the narrative answer, probe for more specific story details. Looking for as detailed a retelling as possible, along with the emotions associated with the experience.]

- You mentioned _____. Will you tell me more about that?
- What was the story behind _____?

Final Questions:

- (If applicable) How, if at all, has your service-connected disability [and/or combat experience] affected your student experiences?
- Reflection: If anything, what do you wish you had known before becoming an engineering student [continuing as a civilian engineer]?

APPENDIX D

UNIVERSITY EXEMPTION FOR HUMAN SUBJECT TESTING



EXEMPTION GRANTED

Samantha Brunhaver
Polytechnic School - EGR Programs
480/727-1883
Samantha.Brunhaver@asu.edu

Dear Samantha Brunhaver:

On 1/22/2018 the ASU IRB reviewed the following protocol:

| | |
|---------------------|--|
| Type of Review: | Initial Study |
| Title: | Understanding Veterans' Experiences as They Relate to Transitional Pathways in an Undergraduate Engineering Program |
| Investigator: | Samantha Brunhaver |
| IRB ID: | STUDY00007555 |
| Funding: | None |
| Grant Title: | None |
| Grant ID: | None |
| Documents Reviewed: | <ul style="list-style-type: none">• Study Protocol, Category: IRB Protocol;• Interview Questions.pdf, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions);• Consent Form.pdf, Category: Consent Form;• Demographic Information Survey.pdf, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions);• Recruitment Email.pdf, Category: Recruitment Materials; |

The IRB determined that the protocol is considered exempt pursuant to Federal Regulations 45CFR46 (2) Tests, surveys, interviews, or observation on 1/22/2018.

In conducting this protocol you are required to follow the requirements listed in the INVESTIGATOR MANUAL (HRP-103).