

Half-fulfilled Promises: Creating a Veteran-friendly Space in Engineering Graduate Programs

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Abstract

This qualitative study explored essential components of veteran-friendly community development in an engineering graduate program. Through the analysis of faculty mentors' and student veterans' in-depth interview data, we identified four themes: (1) Mentors' empathetic understanding, (2) Celebrating and utilizing military assets (3) Creating a military-safe space with multiple layers of support, and (4) Half-fulfilled promises. Findings from this study illuminate significant challenges in creating a veteran-friendly space inclusive of all veterans, especially historically minoritized student veterans. We highlighted the critical role of faculty mentors in serving as a protective buffer for student veterans of color. The results from this study provide pragmatic implications for university stakeholders committed to developing a genuinely veteran-friendly community in STEM graduate programs.

Introduction

Over the past few decades, the science and technology sector has drawn great public attention as people witness its visible impact on society and everyday lives. The rapid development of global scientific and technological developments also fueled the proliferation of STEM (science, technology, engineering, and mathematics) careers and STEM education. The nation expects a significant increase in the STEM workforce over the next decade [1]. A STEM career is now considered a competitive and financially rewarding professional path for aspiring individuals based on its profound societal impact and industrial vitality. One of the most significant challenges in STEM education is its lack of diversity. Despite the increasingly diverse American society and the globally interconnected nature of the science and technology industry, U.S. STEM education has constantly failed to tap into the potential and talents of its diverse population. Scholars have shown consistent racial and ethnic inequity in attaining STEM degrees across various groups of students, which is unique to STEM disciplines [2].

One of the promising student groups to enrich diversity in STEM education and, ultimately, STEM workforce is student veterans. Student veterans have become an important subgroup of diverse students on American college campuses today, with 909,320 beneficiaries receiving education benefits in 2019 [3]. As the racial/ethnic demographics of the U.S. military are more diverse than ever [4], the proportion of military veterans and student veterans of diverse racial and ethnic backgrounds will naturally increase over the years [5]. Student veterans are non-traditional college students with extensive professional training, leadership experiences, and mature and real-life grounded perspectives [6]. As a result, student veterans are an optimal pool for STEM recruitment which educators have not tapped into. Recent statistics show that STEM degrees account for 14% of 380,000 degrees awarded to student veterans between 2010 and 2016 [7] ranked second to the number of degrees in business/marketing (26%). These statistics confirm that the proportion of student veterans gaining a STEM degree is much lower than the overall student population (18%) [8], suggesting that further growth is possible in this non-traditional student population.

Literature Review

Although veterans' transition to higher education is an arduous process plagued with multiple challenges and a need for identity re-configuration, the unique set of their professional dispositions and skill sets contribute to their academic resilience and perseverance. For student veterans in engineering programs, many of their former military experiences prepare them to develop clear and effective communication skills and teamwork capacity, which are highly valued in engineering fields [9] [10]. Based on their prior military experiences, student veterans are also likely to possess a strong work ethic and a keen interest in practical problem-solving. What student veterans bring into the engineering classroom and engineering field is not limited to demographic diversity or professional dispositions and skillsets. Based on their prior military experiences, student veterans enrich STEM program environments by sharing their first-hand knowledge of real-life issues and pragmatic insights that are pivotal to understanding the impact of engineering decisions in a global, economic, environmental, and societal context [10]. Engineering programs are regarded as a selective and demanding discipline thriving on individualism [11], competition, and male-dominated discourse [12] [13]. Many engineering graduate programs, especially those running experimental labs for research and innovation, are built upon an apprenticeship model [14] [15] [16], which conceptualizes student learning through a more experienced tradesperson's modeling and an apprentice's gradual development of designated skillsets, behaviors, and identity under the master's close supervision. Engineering research labs typically have leading faculty members and graduate students who provide intellectual labor while gaining credentials and experience toward the next stage of their careers. It is a traditional model assuming the graduate students as those willing to make a total commitment to their training and relatively free from real-life responsibilities.

However, research has indicated that student veterans do not fit into the model of a traditional student [10], as they are older adults with real-life responsibilities and possibly handling other physical and/or invisible disabilities. Unlike younger peers in their graduate programs, graduate student veterans are not a tabula rasa waiting to be molded by faculty members but highly mature professionals who have accumulated significant knowledge and insights from their prior military experience. They possess distinctive strengths, challenges, and areas for further development, all of which are deeply intertwined with their enduring military identity and various complications from prior services (e.g., physical disabilities, psychological disorders) [17]. This means that student veterans may not benefit from the faculty's blind application of the traditional apprenticeship model typically found in many graduate engineering programs. Given the characteristics of student veterans and the unique academic environment of engineering graduate programs, faculty interaction and peer relationships can play a critical role in facilitating or hindering these students' successful academic or career advancement [18].

STEM programs, in particular, epitomize the privileged space of White males grounded in the meritocratic norms of success through solitary, individualistic, and competitive practices [19]. There is no shortage of literature testifying that universities' STEM programs are a hazardous sphere for underrepresented and marginalized students such as Black, Latinx, and Native American students [20]. These students are often subject to faculty and peer scrutiny and doubt regarding their qualifications and capabilities to succeed in STEM [21]. Facing negative

stereotypes and experiencing subtle but degrading racial microaggressions are also commonplace [20] [22]. In their systematic thematic synthesis, Ong et al. [19] articulate the concept of “social pain” triggered by rejection and feeling left out, which ultimately diverts one’s cognitive resources away from the academic task to cope with emotional stress prompted by the social environment. Each of these added adversities perpetuates and exacerbates the already established social, academic, and economic disparities between racially minoritized students and their White counterparts [20]. Scholars explain that persistent racial and ethnic inequities in STEM disciplines are not coincidental, but an inevitable outcome of “structural racism in higher education [that] keeps underrepresented students of color marginalized and feeling like outsiders at predominantly White institutions [23] (p. 40).”

Student veterans are one of the promising student groups to enrich diversity in STEM education. As the racial/ethnic demographics of the U.S. military are more diverse than ever, the proportion of military veterans and student veterans of diverse racial and ethnic backgrounds will naturally increase over the years [5]. However, the proportion of student veterans gaining a STEM degree (14%) is lower than the overall student population’s statistics [8], suggesting that STEM programs have failed to recruit non-traditional, highly diverse students [18]. Women veterans and racially minoritized student veterans, in particular, are positioned at the intersections of multiple marginalities (veteran status, race, gender), which complicate their transition experience in their STEM programs historically dominated by White males and a stronghold of hegemonic whiteness.

In this three-year-long qualitative research, we explored the major factors that supported the development of a veteran-friendly community in an engineering program and examined its potential and limitations. In particular, we focused on faculty-student mentoring relationships and peer dynamics to understand graduate student veterans’ sense of belonging (or lack thereof) in the program environment. The following two research questions guided our inquiry.

- What is the cultural and relational context of a veteran-friendly community created in an engineering graduate program?
- What are the major dilemmas and challenges in creating a veteran-friendly space inclusive of all veterans, especially historically minoritized student veterans?

Methods

This study was conducted at a public university located in the Southeast, with approximately 1,000 students utilizing GI benefits. In the fall of 2019, 109 graduate students were GI beneficiaries, which accounted for 10.5% of the total of 1038 GI beneficiaries on campus. Out of the 109 graduate students, twenty students were enrolled in STEM disciplines. The university’s Office of Student Services estimated that the number of graduate student veterans will be higher than those shown on their list of on-campus GI beneficiaries as most student veterans have already used their GI benefits to complete their undergraduate degrees.

The study is multi-year mixed-methods evaluation research aiming to track student veterans’ academic and professional development in an engineering graduate program. The entire evaluation research includes multiple types of data such as student veteran recruitment and

enrollment statistics, observations in target engineering classes, student learning outcome surveys, and interviews with faculty, staff, and student veterans and non-veteran students. This paper presents findings based on in-depth interviews with 11 graduate student veterans and eight faculty members who served as academic mentors. Out of the 11 engineering students, all were male student veterans except one—nine of the student participants identified as Caucasian. The sample included one African American and one Asian American student veteran. All eight faculty members were males, with only one faculty member having former military experience—five out of the six faculty members were Caucasian, and three were Asian. Pseudonyms are used for all participants in the table listed below. All veteran participants, both 11 students and one faculty member, were enlisted service members. The years of their military services ranged from two and a half years to 20 years. (See Table 1: Participant Demographics)

All interviews lasted approximately 30-60 minutes, with one student veteran completing a second interview. All interviews were transcribed verbatim and checked by the interviewers for accuracy. The research team conducted a preliminary thematic analysis [24] and elicited the four themes listed below. The research team followed the general guidelines of thematic analysis, starting with careful reading and re-reading of all interview transcripts. The lead investigator/qualitative evaluator and her research assistant developed an initial set of descriptive codes to capture the critical points made by the participants. The team used Nvivo, a qualitative data analysis program, to ensure a consistent and systemic coding process and generated several distinctive patterns and preliminary themes. After reviewing the emerging themes and their empirical evidence, the research team created an analytic table listing the themes and key codes that supported each of the themes. The research team also examined the logical alignment across the emerging themes and their sub-codes and interrogated them against the two research questions. The initial themes and related codes were repeatedly revised and refined through multiple discussions and re-analyses until the researchers recognized clear patterns within the data and concluded on the final four themes reported below. (See Table 2: Summary of Codes and Categories) Therefore, the data analysis was a collaborative and reiterative process by the entire research team of five individuals with diverse professional/disciplinary backgrounds and racial/ethnic and cultural identities.

The research team consisted of five members, three faculty members, and two graduate students. The lead researcher was an Asian American female faculty member in the College of Education serving as a program evaluator. The two other faculty members were Caucasian males in the College of Engineering working with student veterans, including the five graduate students who participated in this study. Only one out of the three faculty members is a military veteran. Both the graduate students are Ph.D. students in the College of Education. One graduate student is a Caucasian female, and the other is a Native American female student.

Findings

Our analysis elicited four major themes that characterized the overall program experiences of the student veteran mentees and their mentors. They are: (1) Mentors' empathetic understanding, (2) Celebrating and utilizing military assets, (3) Creating a military-safe space with multiple layers of support, and (4) Half-fulfilled promises. This study illuminates both potential promises and

significant challenges in creating a veteran-friendly space inclusive of all veterans, especially historically minoritized student veterans.

Mentors' Empathetic Understanding

Our analysis clearly illustrated that faculty mentors' empathetic understanding of student veterans' invisible struggles, needs, and STEM career potentials were the first step toward a veteran-friendly program environment. Unlike many faculty members who simply assume that student veterans have enough education benefits to complete any degree, most mentors in our study (75%) explicitly discussed that veterans' typical education benefits are insufficient to earn a STEM undergraduate degree; pursuing a graduate degree is a far-stretch for veterans both financially and emotionally. One faculty member shared, "Most people pursuing a STEM degree in physics, chemistry, biology, or engineering, they get the first semester of their college credit through their liberal arts classes. And then they have three and a half years of a five-year program and only three years of funding to get it done. So, a lot of the students, by the time they hit their senior year are paying out of pocket or are dipping into other programs like Voc-Rehab to finish." Although all student participants had some government funding to support their education during data collection, three veterans expressed their concerns regarding finances. One stated, "I think a lot of veterans, they log out after their four years because they don't have the money to continue to get an education." The faculty mentors were keenly aware of the dedication and sacrifice made by their student veterans every day to stay in a graduate program, especially those still on active duty or with family obligations. One faculty member shared, "One of the ways that I try to encourage them is that 'I know you're sacrificing your own personal life, your family, but after you get Ph.D., you're going to have much, much bigger opportunities with much, much better salaries.'" By showing their understanding and providing a long-term career prospect, the mentors assisted student veterans to relieve their emotional burden and focus on their long-term professional goals.

Celebrating and Utilizing Military Assets

Faculty mentors also showed a mindset that dispelled the negative stereotypes of military veterans; they also appreciated various professional and cultural dispositions student veterans bring to the table. Most importantly, the mentors proactively celebrated and utilized student veterans' military assets to support and enrich their program experiences and professional growth. One mentor highlighted, "It either directly or indirectly indicates that they have some level of experience and maturity, ability to communicate clearly. A lot of the factors that required them to be either a soldier or whatever position they had, that's the experience that they'll bring with them. And showing that the fact that they're a veteran, it's almost like a certificate showing you have had experience and deliver these things." Faculty mentors specifically emphasized the mentee qualities and work ethics as distinctive in student veterans. Most of the faculty mentors (85%) discussed and stressed their appreciation for the level of maturity student veterans present in graduate programs. One faculty member stated, "they (student veterans) are more mature, and they have a much clearer idea of what they want to be... I hate to generalize, but I feel that overall, their logical thinking is also more coherent. So, they are better able to articulate their thoughts; their thought process is more organized. Oh, one more thing, they value what they have." All student veterans recognized that their work ethic is different from many non-veteran

peers in classrooms. One student veteran explained that he is predisposed to work hard because of his prior military training, which sets him apart from non-veteran peers. He stated, “I think a lot of students don’t have the work ethic to get work done. In the military, it’s kind of expected that everyone’s getting their job done, at least where I was in the military. So, if you kind of mess up, you can kind of just be like, ‘what the heck is going on? You need to do this!’ but I can’t really do that in the classroom.” Another student veteran noted, “the discipline aspect between veteran students and non-veteran students is night and day.” Considering the demands and rigor of engineering programs, it is not surprising to see the student veterans’ strong work ethics and other unique professional dispositions celebrated by the faculty mentors and utilized by student veterans aspiring for a professional engineering career.

Creating a Military-Safe Space with Multiple Layers of Support

Student veterans spoke about their desire to be around competent and caring faculty members/mentors who recognize their military assets and help them achieve their professional goals. One student veteran said, “The best way for me to improve myself is to be around people that inspire me. So I need to spend more time around some of these professors and professionals that are in the industry, specifically researchers. And hopefully, I’ll start to assimilate to their level of research or studying.” The veteran mentees’ search for connection and understanding was reciprocated by the faculty mentors as well. Many faculty mentors mentioned interactions with student veterans outside of the traditional office meetings and classroom time. Some faculty mentors stayed in their offices late, beyond the standard work hours, which student veterans took advantage of in order to connect with their mentors, brainstorm about research ideas or future plans, or simply seek general advice.

The successful development of the military-friendly space in the program had multiple embedded contextual layers, ranging from a micro-level (e.g., program/department) to meso (university) and macro (policy) levels. Despite some challenges at all three levels, the most pivotal element to building a veteran-friendly lab environment was the strong sense of shared community among involved faculty members who collectively supported the student veterans in both formal and informal ways. A faculty member explained his open-door policy, “I expect all of my students to wander in; I have a tendency to wander around the building, at least to go into the labs where I expect to find people working and chat with them .” Another faculty member who also serves in additional roles within the department emphasized collaboration among faculty members to better support student veterans. He noted that although he is not as involved as some of the other faculty members in student veteran mentoring, he is always available to provide support to faculty who are, saying “...people that work a lot closer with veterans than me, when they come here seeking help or are seeking advice, I’m here to help them, provide them advice.” Another faculty mentor echoed the same point, “we even would hang out and chat outside of work as well. Like any good, healthy work environment, you know, people would.” The faculty mentors and student veterans co-created and sustained a fluid, holistic social space in their lab environment where they share their research projects, ask questions, hang around, and chat about many other things. The strong sense of community permeated the lab environment and resembled the characteristics of military camaraderie, a lost and found peer connection to the student veterans.

On the meso level, the student veteran services office appears to be well known among both student veterans and faculty members. Three of the faculty mentors recognized the student veterans services office as a valuable resource and point of contact for student veterans. One faculty mentor stated, “I think they do a good job supporting the students if the students are close and have the time. So, the lounge for our freshmen and sophomore students who are on the main campus, the lounge area, the counseling, and popup employer things they do in there, the LinkedIn things, are really good...”. Similarly, most student veterans (N=6) also recognized the student veterans services office as a great resource; however, they noted that the challenge is its location. One student veteran stated, “...sometimes I go to the lounge, it’s difficult for us five engineers over here to go to the vet lounge. You got to get on the bus, you gotta go over there, you gotta get off the bus, and you got to walk through campus to get there.” Faculty mentors were well aware of this challenge. They took it upon themselves to advocate on the university level for the development of another veteran’s lounge closer to the engineering department. One faculty mentor emphasized, “...there’s a sense of camaraderie with veterans over on the other side of campus, it’s a mile away. And they have coffee machines and lounge stuff, and they can hang out there and talk about things they want to talk about.”

Half-Fulfilled Promises

However, the veteran-friendly space was only a half-fulfilled—so half-empty—promise. Faculty mentors shared that they were still dealing with the lack of meaningful support from the department. Some participants questioned the university’s commitment to establishing a genuinely veteran-friendly campus environment given the lack of progress with crucial student veteran-related initiatives. One faculty mentor wondered, “You could ask the question why institutionally veteran's day is not a holiday or at least not a day off,” since “..we're packaging ourselves as being” the university that has historically served military veterans and wants to continue to attract student veterans.

Most importantly, the informal peer context of the veteran-friendly space turned out to be hazardous to minoritized veterans as they experienced microaggression in the everyday peer interactions inevitably dominated by White male veteran peers. Two minority graduate student veterans did not find the “veteran-friendly” engineering lab environment a safe or comfortable social place. A minority veteran confessed that “veiled racism” is ever-present at the university, which he evaluated as a form of ignorance rather than hatred. He acknowledged that “the entire world, especially engineering...is very segregated.” He noted that segregation is damaging but implied it could also protect racial minority students like himself from constant racial microaggression. As a result, minority student veterans built an alternative social space outside where they are free from race or gender-related microaggression. The only female veteran in our study confessed that she found a sense of camaraderie with other female non-veteran graduate students rather than the male student veterans in the same mentoring program. She shared, “I personally love just the camaraderie that we have as females, just all working together. And I hate the stereotype that when you get a lot of girls working together, it’s all catty or like, and that’s just not true.” Another racial minority student veteran actively sought peer support by expanding his social network to other diverse students beyond his program and lab environment. While other White student veterans prefer not to associate with younger students, he states:

I started hanging around the young kids that I'm hanging around with now that are like 23, 24, but they were socially responsible. I don't have to worry about them calling me the N-word. And they're um, they're all diverse racially and ethnically...we're all different ethnicities, and we all have the highest respect for each other.

Still, both minoritized student veterans found their mentors' holistic support and guidance pivotal to their academic and professional growth and enabled them to gain a positive experience in the program. The mentors played multiple roles for the minoritized student veteran mentees and "fill[ed] in all the slots for other positions that are supposed to be helping me[them]."

Discussions and Implications

The results from this study provide important insight into the experiences of engineering graduate student veterans and how various units of higher education (e.g., institutions, programs) can develop an effective and culturally relevant support system for *all* student veterans. Built upon the existing literature on student veteran mentoring, this study offers a more nuanced and complex portrayal of a graduate student veteran mentoring program that featured multiple layers of institutional and programmatic support as its pivotal elements. Most importantly, our last finding elucidates the continuing struggles experienced by historically minoritized student veterans who face and deal with constant and normalized microaggressions on campus and even in the military-safe lab environment.

At large, our study shows that both faculty's understanding and advocacy and the presence of a holistic support community in the program are essential to a veteran-friendly space in an engineering graduate program. It confirms prior studies that student veterans' military identities persist long after their civilian transition [25]. They flourish in an environment where their military identities are affirmed and their military assets are valued and proactively utilized to pursue a new career goal in civilian society [9]. Therefore, understanding their enduring military identities and valuing what they bring to the engineering profession are still pivotal to any program that intends to support student veterans moving beyond undergraduate degrees.

Most importantly, this study reveals that the military-friendly engineering lab environment—despite all good intentions—can remain an unsafe, even hazardous space for historically minoritized groups. While being considered an invisible minority in higher education [26], most graduate student veterans are male and Caucasian, a privileged group of individuals in current American society and engineering. Therefore, to develop a genuinely safe space for *all* veterans, engineering faculty members and graduate mentors also need to be made aware of the norms that define their disciplinary culture and how it impacts diverse groups of students in their programs [27], especially historically underrepresented racial/ethnic minorities and female students.

Study Limitations and Recommendations for Future Research

As a small-scale-qualitative case study conducted at a specific institution in the Southeast, this study presents several limitations. Qualitative research findings are deeply situated. Therefore, findings from this study should be understood within its regional (southeast), institutional (PWI), and programmatic (engineering) contexts. For example, we believe future studies with graduate

student veterans on non-PWI campuses may generate some differences as the cultural and racial climate of those campuses significantly differ from our institution. Also, due to the extremely low representation of historically minoritized student veterans in the entire engineering program, our analysis of the sub-group remained a limited case analysis, rather than a more systematic thematic analysis across multiple cases. Acknowledging the limitations in the regional/institutional context, sample, and analysis, we strongly recommend that future studies be conducted in a place with a different racial and cultural climate (e.g., Minority-serving institutions) and utilize a more diverse sample to draw a more systematic and holistic account of student veterans' experience of mentorship in graduate engineering programs.

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Table 1
Participant Demographics

Groups	Pseudonym	Race/Ethnicity	Gender	Branch	Service Years	Undergraduate major	Graduate Program
Student veterans	Jamie	African American	Male	Army	10	ME*	MS in ME
	Caleb	Caucasian	Male	Army	6	EE**	Ph. D in EE
	Scott	Caucasian	Male	Marines	2.5	ME	MS in ME
	Alex	Caucasian	Male	Air Force	6	ET***	MS in AEMS****
	Dave	Caucasian	Male	Army	21	ET	MS in AEMS
	Max	Caucasian	Male	Marine	5	ME	MS in ME
	Pete	Caucasian	Male	Navy	8	ME	MS in ME
	Jake	Caucasian	Male	Marines	10	ME	MS in ME
	Uriah	Asian	Male	Navy	10	EE	MS in EE
	Kyle	Caucasian	Male	Air Forces	5	EE	MS in ME
	Tammy	Caucasian	Female	Army	6	Biochemistry	MS in Chemistry
Faculty mentors	Dr. Tahil	Asian	Male				
	Dr. Eastwood	Caucasian	Male				
	Dr. Tulbert	Caucasian	Male				
	Dr. Donlick	Caucasian	Male	Army	20		
	Dr. Lambo	Caucasian	Male				
	Dr. Cherub	Asian	Male				
	Dr. Meno	Caucasian	Male				
	Dr. Uros	Asian	Male				

*ME: Mechanical Engineering

**EE: Electrical Engineering

***ET: Engineering Technology

****AAMS: Applied Energy & Mechanical Systems

Table 2
Summary of Codes and Categories

Themes	Sub-themes	Mentor (8)	Mentee (11)
Understanding and advocating for student veterans	Financial concerns	6 (75%)	3 (27%)
	Student veteran challenges (i.e.age, racism, credits, cultural differences, unstructured environment)	7(87%)	10 (90%)
Acknowledging military cultural assets	Maturity	7(87%)	-
	Work ethics	5(62%)	6(55%)
	Military background	4(50%)	6(55%)
Authentic and holistic mentoring	Trusting collaborative approach	7(87%)	6 (55%)
Co-creating veteran-friendly holistic space	Micro-level (program/department)	8(100%)	5(45%)
	Meso-level (university)	5(50%)	6(55%)
	Macro-level (policy)	2(25%)	9(82%)
Half-fulfilled promises	Race discrimination		2(18%)
	Gender differences		1(9%)