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Exploring the Experiences of First-Generation Student Veterans in Engineering

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Exploring the Experiences of First-Generation Student Veterans in Engineering

Abstract

Understanding the experiences of first-generation students is important for expanding diversity and inclusion in engineering education. Some of these students may include the military as a part of their educational pathways. However, there is little research on the experiences of first-generation student veterans in engineering education. This qualitative study seeks to address this gap. The investigation focuses on first-generation student veterans in engineering (FGSVEs) (n=15) who were interviewed as a part of a larger study of SVEs (n=60) on four college campuses. The study addressed the following research questions:

- (1) Why do FGSVEs decide to join the military?
- (2) Why do FGSVEs choose to major in engineering?

Results suggest that these FGSVEs join the military to gain some direction and purpose in their lives and to pay for college. They primarily choose engineering as a pathway toward financial stability and to engage in creative problem solving. This study reveals that the military provides opportunities to first-generation students that would otherwise not likely be available to them due to their reported lower level of motivation and academic discipline during and after high school. The study results can aid in the development of recruiting strategies and the design of more effective programs and policies for SVEs in general and first-generation SVEs in particular. For example, because many of these students overcame initial obstacles in higher education, they could be a potential pool of effective mentors in engineering, both to other student veterans and to first-generation students.

Introduction

Between the enactment of the 2008 Post 9/11 GI Bill and May 2017, the US government invested \$75 billion in financial aid to student veterans desiring to attend college [1]. The increased presence of student veterans on college campuses has resulted in the creation of programs and policies to address their needs and ensure a successful transition to higher education. While many of these initiatives have been successful, the “one-size-fits-all” approach has minimized the effectiveness of others [2]. It is essential to better understand the experiences of the various subpopulations of student veterans to ensure their higher education needs are adequately met.

To this end, our paper characterizes the experiences of first-generation student veterans in engineering (FGSVE) at four universities. Much of the research on first-generation students (those students whose parents did not attend college) is on traditional college students who initiate their college studies immediately after high school graduation. However, first-generation students (FGS) who have served in the military generally have more complex and lengthier pathways into higher education. To better understand these FGS’ pathways, our current study addresses the following research questions:

- (1) Why do FGSVEs decide to join the military?
- (2) Why do FGSVEs choose to major in engineering?

Our focus on student veterans in engineering (SVEs) addresses a gap in the literature on first-generation students and should be of interest to engineering educators, higher education administrators, and policy makers. The current student veteran population can help to increase the number and diversity of students in engineering. Extrapolating from data on post-WWII veterans (sources suggest that 450,000 engineers were supported through the original 1944 GI Bill; [3]), by 2020, an estimated 280,000 engineers are likely to be supported through the Post 9/11 GI Bill, now called Forever GI Bill [4].

The student veteran population can help diversify engineering education since, compared to civilian students, student veterans are more likely to be older, first-generation, disabled, and African American or Latino. The military pathway also holds promise for attracting highly qualified individuals to the field, as many military jobs are highly technical in nature [5]; student veterans are more likely than their non-veteran peers to be able to translate these skills to more diverse work environments [6].

Literature Review

First-Generation Students

A sizable proportion of college students are the first in their family to attend college: 24 percent of 2002 high school sophomores who enrolled in a postsecondary institution by 2012 were first-generation students [7]. Research shows that parental education and family income and socioeconomic status affect persistence in higher education. A predominant theme in the literature on first-generation students (FGS) is that they experience a range of challenges in

higher education and often do not fare as well in college as their continuing-generation counterparts.

Researchers have asserted that parents of FGS are often not able to provide their children with the social capital and information necessary to enter the college pathway and succeed once they arrive to college [8], [9]. FGS ultimately are less likely to graduate [10]. If FGS do ultimately graduate, the disadvantages of first-generation status are likely to extend into the labor market [11]. As such, these challenges can lead to gaps in opportunity, awareness, and achievement in higher education and beyond [12].

First-Generation Students in Engineering

The research on the entry and experiences of FGS into Science, Technology, Engineering, and Math (STEM) majors is mixed. One study found that FGS are often not adequately informed about STEM educational pathways and career opportunities [13]. However, according to Ma [14], students from low socioeconomic status (SES) families (measured by parental education level, occupation, and income) are more likely than high SES students to choose careers that pay higher incomes, such as STEM majors. After controlling for race, ability, family income and gender, first-generation students are more likely to choose engineering than non-first-generation students [15], likely selecting these majors as they offer a clear and potentially stable and financially attractive career path.

Nonetheless, first-generation students are at a disadvantage in some STEM fields. FGS face several barriers that influence their performance in engineering education, including inadequate academic preparation during high school and the subsequent need for remedial classes [16], the absence of engineering role models, and lack of parental understanding about engineering [17]. Extracurricular activities, such as internships, student organizations, co-ops and study abroad, are an important source of social and cultural capital for FGS [18], especially in engineering. However, FGS students are less likely to participate in such opportunities while in college [19]. FGS are likely to work while in college and this may negatively influence persistence in engineering majors due to the large time demands in some of these majors [20].

Student Veterans

Since 2009, more than a million veterans have returned to school to earn an Associate's, Bachelor's or graduate degree. Indeed, as our research concurs, student veterans are nearly equally as likely to say they joined the military for the government-provided educational benefits as they were to join to fulfill a desire to serve their country [1]. Others choose to join the military because they feel they would not succeed in college due to poor performance in high school or had demonstrably not succeeded in college and because the military provides an alternative pathway to working in low-wage jobs [21]. Once student veterans decide to attend college, they are likely to make good use of their educational benefits. The college completion rate for student veterans is higher (53.6%) than the national completion rate (45.9%) and the rate for other adult learners (those enrolled in college for the first time at age 25 years or older - 39.2%; [1]).

Student veterans have much in common with other non-traditional students in college: they are more likely to be older, married, have children, to be working full- or part-time, and be a first-generation student [1] [22]. Two-thirds of combat veterans responding to the 2010 National Survey of Student Engagement reported they were first-generation students [23]. As such, it is important to learn whether first-generation student veterans encounter similar obstacles as those encountered by non-veteran first-generation students. According to Durdella and Kim [23], these challenges may include lower educational aspirations, lower levels of social capital, and weaker academic preparation. Because student veterans are generally older than traditional college students, it could be the case that first-generation student veterans experience different challenges not related to their family of origin, but rather to their own families.

Student Veterans in Engineering

Although veterans have not previously been strongly encouraged to go into engineering undergraduate programs, their military experiences make some well-suited to pursue engineering degrees. According to the NSF Workshop on Enhancing Post-9/11 Veterans Educational Benefit, for example, the veteran population holds great promise for expanding and diversifying the engineering and sciences workforce [24]. Haynie [25] argues that military veterans are well suited to STEM majors, given that military training often exposes them to technological tasks across a variety of fields; many also strengthen their “soft skills” such as teamwork, leadership, and communication skills.

The current study aims to address a gap in the literature on student veterans in engineering by focusing on the experiences of first-generation students. Thus far, our project has investigated SVE pathways into engineering education [26] [27], the quality of SVE transitions into higher education [28], and the institutional environment for SVEs [29]. The current focus on FGSVEs extends our prior work that highlighted the experiences of first-generation engineering transfer students [30] [31].

Methods

Our study, funded by the National Science Foundation, investigated the experiences of SVEs at one private and three public institutions in the U.S. Our multi-method qualitative approach utilized key informant interviews (n=23), SVE focus groups (7 focus groups with 29 participants), and SVE in-depth interviews (n=60). For this paper, we draw on a subset of the SVE in-depth interviews, focusing on the in-depth narratives of first-generation SVEs (n=15) as their narratives relate to their pathways into the military and engineering education.

We recruited interviewees through our network of contacts in the college of engineering, in student services, and the student veteran groups on each campus. The Institutional Review Board at each institution approved our study; the interviews were conducted between Fall 2016 and Spring 2017. Each interviewee received \$50 for participating. Our interview protocol included questions about motivations for joining the military and for choosing the engineering major, the transition from the military to higher education, and current engineering education experiences.

After the interviews were transcribed and verified, we began the analysis process by writing episode profiles (summaries) for each interview. We then selected power quotes to highlight key points related to our research questions on FGSVEs [32]. Following Strauss and Corbin [33], our subsequent three-step coding process consisted of open coding (identifying key themes related to our research questions), axial coding (categorizing the initial themes into the broader themes as they related to the experiences of the FGSVEs) and selective coding (connecting these latter categories with one another and identifying subcategories within each). We then created a matrix of codes and themes that allowed us to compare across and within participants' transcripts to assess the depth of the various themes identified [34].

Description of Sample

Our final sample for this paper included 15 FGSVEs who were enrolled in an undergraduate program in engineering. These students indicated that both parents had an educational attainment level of "some college" or less; that is, neither parent had earned a college degree of any kind. The one woman and 14 men in our final sample included the following engineering majors: mechanical (ME; n=4), aerospace (AE; n=3), electrical (EE; n=3); chemical (CH; n=1), construction (CN; N=1) general (GE; n=1), material science (MS; n=1) and textile (TX; n=1) engineering. Participants served in the Air Force (n=4), Navy (n=4), Army (n=3) and Marine Corps (n=3); one participant had served in both the Coast Guard and Air Force. Three had also served or were serving in the National Guard and one in the Reserves.

Ten participants identified as White, four as Black, and one as Latino. In terms of parents' education levels, seven participants indicated that at least one parent had "some college." For the other eight participants, neither parent had any college experience; five of the eight indicated that both parents had earned a high school diploma, while the other three participants indicated that one parent had less than a high school education and the other had earned a high school diploma.

When reporting the results, we use a pseudonym for our study institutions (A-College, B-College, C-College and D-College). Student quotations are identified by institution code (A, B, C or D), interview number (1...15) and major. For example, a mechanical engineer from institution C who was the twelfth student interviewed would be represented as C12ME. To preserve the confidentiality of the female participant, only masculine pronouns are used.

Results

Research Question # 1: Why Do FGSVEs Decide to Join the Military?

Student veterans joined the military to gain a sense of direction. Participants indicated that they joined the military because they lacked a sense of motivation, purpose and direction, especially after high school or during their first attempt at college. For example, B1TX said he "*didn't care to do well*" in high school and spent much of his time working outside of school, often 40-hours per week. He joined the military as "*the best route to get myself out of the position I was in...I had no direction because I couldn't go to college.*" D4EE said that by the time he finished high school "*I was sick of school; didn't want to go anymore.*" He felt that college was not in the realm of possibilities, especially considering his parents' education level:

“College wasn’t an option, really, for me. My parents...didn’t go to college. My dad didn’t graduate high school.”

Despite reservations about their ability to succeed in higher education, several participants still attended college immediately after high school. For example, A15ME initially attended A-College right out of high school, in response to pressure from his family to do so and because *“everyone expected me to do that.”* However, *“it finally got to the point where I was tired of school, and me leaving school, I kind of wanted to be productive.”* He then flunked out of college and joined the military. B9AE said he was *“academically unmotivated”* the first time he attended college: *“I would never do my homework, I would never do anything extra that I didn’t have to, I never studied for a test like in my life.”* He said he ultimately *“ended up in the military by default.”* He later says that he probably would not have ended up in engineering had he remained at B-College. Thus, his military pathway gave him more clarity about his career goals.

A2ME described being an unmotivated high school student who had *“no direction”* and a short-term outlook: *“Most high school students can’t see past their own nose and I was the same way.”* His first attempt at college was a *“trial run.”* After failing out of college, he worked several low-wage jobs and began to consider other options for improving his occupational pathway: *“I realized that [working for a convenience store] wasn’t a career path and I didn’t want to work on cars for the rest of my life.”* For A14ME, high school was a *“wash”*; as a result he was *“clueless”* after high school graduation and he *“never knew what I wanted to study or anything.”* Even so, he attended a local community college for 2 1/2 years where he was *“just taking general studies and didn’t really know what I wanted to do. So I think that really pushed me towards the military.”*

Student veterans joined the military to obtain military-provided educational benefits. As a second motivation for joining the military, nearly all of the participants *indicated that they joined the military for financial reasons.* That is, the opportunity to receive financial aid through the GI Bill was paramount in their decisions. For example, B12AE indicated that he didn’t join the military for the *“right reasons”* such as *“having a strong belief, changing the world or anything.”* Rather, he joined because he was *“in a bind financially.”* If it was not for the military, A14ME said he *“would not be [in school], for financial reasons.”* A8MS, a self-described *“money-minded”* individual, said that he has been working for pay since he was 12 years old; his decision to join the military was a strategic extension of this mindset. He specifically decided to join National Guard because he felt *“they have the best [college] benefits.”* He also described vying to be deployed, so he could then be eligible for GI Bill benefits: *“If I had not had the military, I would not have been able to afford college.”*

B5EE attended an elite private university for three years, before facing financial challenges. At that point, he realized his choices were to *“take out student loans or stop going to college.”* Instead, he dropped out of school and joined the Navy. While he always had the goal of joining the Navy, he had anticipated earning a bachelor’s degree prior to doing so. Instead, after successful service, he was chosen for the Seaman to Admiral training program and funded to return to school to study engineering.

In several cases, a FGSVE's performance in high school lessened their chances of receiving financial aid to attend college, even if they wanted to attend college immediately. In other words, their lack of success in high school often intersected with their need for financial aid, which in turn, influenced their decision to join the military. For example, A11GE faced financial challenges during high school. His mother, who dropped out of college, suffered from depression, and was unemployed. His father, "*just paying for food and stuff... always kind of struggled.*" A11GE claimed that because he "*slept through high school,*" his grades "*were kind of poor.*" As a result, he "*had no way to pay for college [and] didn't necessarily want to go to college.*" He said, "*[I] knew I wasn't ready for college. I didn't have the work [ethic] for it, for at least, the scholarly work, in the books.*" Realizing that he would not qualify for scholarships, he "*needed a way to pay for college,*" so he joined the military.

The participants who joined the National Guard or Reserves after arriving at college indicated they primarily did so to pay for college. For example, B15CH decided to attend B-College directly after high school, selecting this state university due to its lower tuition rates. His parents paid for his first year of college and then told him "*you're going to have to take it on your own and figure out how to do it.*" He worked full time and still "*didn't make enough money to survive.*" He soon realized he needed to find a way to pay for school, leading him to join the National Guard. Similarly, soon after arriving at C-College, C8CN found it difficult to juggle student loans and maintain his grades. As a result, he decided to join the National Guard to help pay for college, while serving the country and "*liv[ing] out his military dreams.*"

Research Question # 2: Why do FGSVEs Choose to Major in Engineering?

The FGSVEs described financial and social class factors as influential for selecting the engineering major. Financial considerations factored into participants' decisions to major in engineering. For B15CH and his father, attending college and majoring in engineering was an avenue for upward mobility:

I knew I wanted to go to school for something that was going to make me a decent amount of money, so wanting to maybe change what class I'm in, maybe move up; That was part of my dad's reasoning for really wanting me to go to school. He saw that opportunity for me to essentially have a better life than...he did.

B15CH's rationale for majoring in engineering also represented an intersection between his class identity and his gender identity:

Maybe I want to move up a socioeconomic class, or make more money to move up in that class because...there's the idea - it's not necessarily always true - that males are the breadwinners of the house...so maybe I feel the need to make more money so that if I wanted to start a family I'd be better suited to start a family when I wanted to.

When asked why he decided to major in engineering, A8MS referred to his parents' educational level (what he called "*an important demographic*") as a motivator to achieve more than his parents had:

My father never graduated high school, my mother . . . neither side went to college. I was the first person on my dad's side, I believe, to graduate high school....And, the first person on both sides to go to college.

A2ME cited the “median salary” of engineering jobs as the primary reason for majoring in engineering. His decision was also prompted by a comment from his supervisor in the military, who said that:

'Infantry marines and infantry corpsmen, when they get out, they do one of three things. You're either going to spiral out of control downward and we're never going to be able to stop you. You're going to become a police officer, or you're going to start a t-shirt company. Pick one of the three.' And...I really don't want to do any of those.

Thus, he ultimately chose engineering as an alternative to these career paths and because “you do pretty well coming out of college and you also have an amazing amount of options for further education.”

A15ME indicated that a career in mechanical engineering would allow him to meet his goals of financial security. When describing the relevance of social class to his identity and career choice: “Just kind of knowing what situation I come from [is important]. Not poor-poor or anything like that. But four kids [his siblings], and just knowing...I wasn't silver spoon fed or nothing like that.” He then describes learning more about the salaries for mechanical engineers (“you get anywhere from 60 to 70 to 80 thousand [dollars]”) and realizing that this was enough for him: “Honestly for me, at this point, I can start on the lower end of the starting salary, and I would be just fine, knowing what I've lived off of.”

Participants were also aware that choosing to major in engineering would likely influence their own children, adding another dimension of intergenerational mobility to their narratives. For example, it was important to C8CN to serve as a positive role model for his future children:

It's a little minor thing, but...I wanna' be able to build stuff for people and one time look at my kid, if I have a kid, and be able to say, “Hey, look, your dad built that. Or he helped manage that.” ...whether it was a plane or car.

D4EE also referred to his children, wanting to show his sons “that I'm this old, and I know what I wanna' do in life, and I'm going for it. I'm gonna' be an engineer.”

Several FGSVEs indicated they had a long-standing interest in engineering. The participants' explanations for majoring in engineering were similar to those for students featured in previous studies of engineering students, such as a lifelong love of tinkering [26]. For example, B12AE developed an interest in engineering as a child, when he “liked to destroy things and take them apart.” For him, “engineering was just something I always wanted to do, I always wanted to build things, and create the new technology that's doing something spectacular.” C8CN said ever since he was five or six years old he enjoyed “playing with the little Army figures, or just playing with Legos,” thus stimulating his interest in engineering.

FGSVE were attracted to the engineering major because of the opportunity to engage in problem solving and to be of service to others. Participants said they developed a passion for creative problem solving during their childhood or while serving in the military, and this ultimately motivated them to major in engineering. For example, A11GE said that he was inspired to ultimately consider majoring in industrial engineering by witnessing the medical challenges that his mother faced during his childhood. He indicated that his mother *“has always been kind of very sick”* and *“overmedicated for a very long time.”* He *“found out industrial engineers...can work in hospitals, and they can work with patients.”* He realized that, as an industrial engineer, he could develop a system to prevent overmedication and *“to help doctors better track medications. And, that is the reason I switched to industrial engineering.”*

When A2ME took a tour of the engineering school at A-College, he realized that with an engineering degree from A-College, *“you walk out of here with a confidence in your ability to solve any problem that’s put in front of you. And, something about that stuck with me because... there’s a satisfaction that you get from problem solving.”*

This rationale related to the problem-solving dimensions of engineering was often derived from military service itself. B1TX was injured while deployed in Afghanistan and wanted to prevent this from happening to other soldiers. Specifically, he was hoping to use his textile engineering degree to improve military body armor: *“the vests are made of textiles, the bullet proof vest...I wanted to make it lighter, more flexible, more movable, less degrading on the body, but still with a good amount of protection.”* By improving the design, he felt that he *“would be doing a lot of good for my brothers.”*

When asked why he chose engineering and members of his military cohort did not, B16ME said:

I wasn’t content with things being messed up and so I was always just wanted to fix it...If there’s something that you can do about it, then do it. And [majoring in engineering] is me doing that something about it...I guess to an extent, everyone was just apathetic to things like that and so I guess that’s just my mindset.

He hoped to apply this approach to building a better Bradley vehicle [infantry fighting vehicle] as *“it doesn’t matter how pretty it is in the Army. It just matters how effective it is.”*

D4EE said these problem solving abilities and technical skills helped to give his life meaning:

The reason for [majoring in] engineering is when I came into engineering and started to think about how things fit together and the life that I’m creating—because engineering, I think, is creating things to help people...I started to think about... “What kind of life am I making?”

Thus, majoring in engineering was part of a larger life goal. His choice to major in engineering was also motivated in the military:

The part that the military did, it was just the fact that equipment was there that I was fixing, and I loved doing it. Then I saw technicians who were pretty bright guys that were

on the civilian side. That made me wanna' see if we can do a better job making some of that equipment. Right when I decided to go into engineering, it was because I wanted to create something better.

D9EE made an explicit connection between his military training and his choice of electrical engineering, saying that *“if it wasn't for the Coast Guard, I would not have ever considered being an engineer.”* His Coast Guard training put him on the engineering pathway as, prior to joining the military, he *“knew nothing about electrical systems...All of my experience with electronics was gained through Coast Guard training, and being in the field.”* After he witnessed many of the military technicians complaining about a problem, he thought *“Hey, maybe I can design something that's easier for these guys to work on later.”*

Discussion

Our study adds to the literature on first-generation students in engineering education. The findings suggest veterans who are first-generation students face challenges in college, such as navigating complex educational bureaucracies and lacking the social capital required for academic success [35]. The results reveal several important factors about the pathways of first-generation student veterans in engineering.

The findings suggest that without military provided opportunities, first-generation student veterans may not have aspired to, or attempted, higher education and career paths in engineering. In many cases, the military experience provided a portal through which they could rebuild their lives despite past academic failures. Several students said that they likely would not have ended up in college or engineering had they not first served in the military. Many felt that they were not at all qualified to attend college, much less major in engineering (As C14 says: “[In high school, I], *“never thought I would have been in engineering - never thought I would have ended up in the military, honestly.”*) Several attempted college for a short time, only to fail out and then join the military to gain a sense of direction. Thus the military served as an essential bridging mechanism for these first-generation students [36], and as a “turning point” in their lives as documented in studies of veterans of earlier wars [5] [37]. It could be the case that the military experience itself altered their educational aspirations [38]. Deficits at the beginning (right out of high school) in terms of confidence, motivation, or skills, were often transformed in the military into assets by the time they enrolled (or, re-enrolled for some) in college. These results confirm Garcia's [39] study of student veteran transfer students. These students were confident in their ability to succeed in college and their military experiences helped them cope with the new role expectations of being a student.

Participants in this study indicated that serving in the military was an essential step toward engineering education, for both tangible (e.g., GI Bill educational benefits) and intangible (e.g., enhanced maturity gained while serving in the military) reasons. In particular, the government-provided financial support was a critical motivator for joining the military. This is not surprising given previous research that indicates that receiving GI Bill benefits is a primary reason many veterans enlisted [40] [41]. But this finding speaks to the idea that recruits do not necessarily join the military as a lifelong career path, but rather as a bridge into college, a path they could not likely have been able to traverse without the tangible support offered through the military. For

example, B9AE said that while he sometimes regrets his decision to go into military, he also realizes that *“I wouldn’t have been through this program of study [aerospace engineering] without it and everything that’s happened in my life.”* Similarly, A14ME indicated that he *“intended to use the military as a stepping-stone. I didn’t want to make a career out of it. I wanted to go back to college and get a degree.”*

It is likely that this sample of first-generation student veterans experienced less financial stress than they would without the provision of military educational benefits. A recent study found that student veterans generally borrow less money than non-student veterans (65% of veterans borrowed no money as compared to 52% of non-veterans) [1]. However, program administrators should be aware that many student veterans still have financial constraints; more than half of student veterans responding to a recent survey indicated that they did not have enough financial resources to stay in college, even with their military benefits [42]. Indeed, several of our FGSVE participants worried about their finances and were quite strategic in stretching their financial aid dollar. For example, B9AE describes wanting to complete a co-op but realizing that he may not be able to do so as he must still work full-time, even though he receives the GI Bill benefits. D4EE worries about running out of GI Bill benefits before he finishes his degree. Recent legislation may ameliorate his and others’ financial concerns. The GI Bill STEM Extension Act of 2017, introduced into Congress in April 2017, would authorize 9-months of additional educational assistance to veterans pursuing a STEM degree [43].

This population of students is different than other first-generation students in engineering in several ways. In addition to the life-changing experiences of serving in the military, their exposure to technical training and ability to apply this training to a variety of settings [6] makes them a “rare, valuable, and differentiated” resource [25, p. 8]. Thus, these first-generation student veterans bring important assets and qualities gained during the military that aid their success in engineering education, including those identified by the Student Veterans of America (SVA) [1], such as a strong work ethic, teamwork, leadership and management, self-discipline, and mental toughness. While in the military, our participants accumulated various forms of capital that put them in a better position, by the time they arrived in college, to succeed in a difficult major. These findings point to a different form of “funds of knowledge” for engineering [44] that are different than the funds of knowledge for non-military FGS.

Our prior study on SVEs documents the influence of the military on selecting an engineering major [26]. For this sample of FGSVE, the opportunity to engage in creative problem solving and to “give back” was an important motivator for entering this educational pathway. A focus on innovation and service to society could likely attract student veterans to engineering.

Limitations

As our sample included students who had persisted in engineering education, we are not including the viewpoints of those students who changed their major or who dropped out of college altogether. Further research on non-persisters could reveal challenges that influence student veterans in engineering.

Our aim here was to characterize the experiences of first-generation student veterans. Future research could better discern the relative influence of generational status on engineering education by including a comparative element. This could be accomplished by highlighting the similarities and differences between first-generation and continuing generation student veterans (i.e., those whose parents had earned a bachelor's degree or higher). Factors such as military branch, gender, race and engineering major, could be investigated. Other factors associated with academic variables (e.g., academic motivation) and military-related variables (e.g., military rank, number of times deployed, military branch, military occupational specialty) could potentially influence their engineering education experiences and outcomes [45]. Additional knowledge about the relevance of first-generation status in engineering education vis-à-vis other dimensions of identity (e.g., engineering identity, military identity, race, gender, etc.) could help expand understanding of the dynamic experiences of FGSVEs.

Future research investigating the experiences of first-generation students could also delineate the influence of parental income level on student experiences. For example, Moore's [46] study on the influence of SES on STEM and non-STEM majors revealed that parental education level had a stronger influence on students in STEM fields than did actual family income.

Conclusion

Engineering education is an attractive career path for both first-generation students and student veterans, especially those seeking a stable career path that offers a potentially secure financial future. The military serves as a stepping-stone away from prior negative experiences in education and toward a path of upward mobility, via higher education and the engineering major.

Our study results provide evidence that first-generation student veterans bring unique perspectives and experiences to engineering education. The student narratives reveal that many of these students would likely not have attended college had they not served in the military, either because they lacked the academic discipline required to succeed or they could not afford to attend college. Given that many of these first-generation students overcame some initial obstacles in higher education, this group of students could serve as mentors, both to other student veterans and to first-generation students who are struggling in college. This is particularly valuable for engineering that still suffers from a lack of diversity among its graduates, even compared with other STEM majors.

The study results also indicate that these FGSVEs are generally enthusiastic about their potential for contributing to society through engineering. In this respect, the engineering education pathway allows for these students to continue to serve their country, while at the same time provides them with an avenue for upward mobility.

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