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Enhancing Student Veterans' Self-Efficacy and Sense of Belonging in a Targeted Learning Community: Four Years of Qualitative Results

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Abstract

Eight semesters of qualitative data, collected over four academic years, are presented from a project that resulted from the development of a student professional learning community of high-achieving, low-income engineering, and engineering technology student veterans. In the context of this project, student veterans received academic, professional, and financial support that helped them succeed academically and prepare them for a career in the STEM workforce. As adult learners, students in this learning community were a vital part of the curriculum development which resulted in increasing the students' interest and buy-in. Typically, adult learners have lower levels of engagement than traditional-aged students. However, by engaging students in the development of a seminar course which served as the foundation for the student learning community, the course curriculum addressed student needs while being built on faculty expertise. Focus groups were conducted at the end of each semester to determine if students perceived the course as an effective professional development intervention. The course was comprised of various guest speakers who addressed different topics related to engineering, and the course also addressed other topics of professional development. In addition to hearing from various guest speakers, students also learned critical professional skills including how to search for an internship and/or permanent position; how to develop a cover letter, resume, and follow-up letter; how to prepare for and respond to questions during interviews; how to present themselves, how to dress, eat and hold a professional conversation at a formal meal during an interview; and how to network and follow-up after meeting people professionally. The guest speakers, veterans themselves, were excited to present to these highly motivated student veterans and to share their stories, and in the process, they inspired this next generation of engineers and engineering technologists.

Keywords: adult learners, engineering, learning communities, STEM workforce preparation

Introduction

The goal of the National Science Foundation S-STEM project, *A Pathway to Completion for Veterans Pursuing Engineering and Engineering Technology Degrees*, is to provide professional development and scholarships to student veterans who are attending Old Dominion University (ODU) in the Frank Batten College of Engineering and Technology (BCET). This project focused on two objectives. The first was to improve pathways and academic success in engineering and engineering technology for low-income, academically talented military, veteran, and adult students. The second was to advance the understanding of effective evidence-based practices that support the recruitment, retention, understanding of academic/career pathways, and graduation of engineering and engineering technology student veterans.

BCET is home to 396 (15.15%) student veterans and active-duty personnel; it has the highest veteran and active-duty percentage of all ODU's academic colleges. There are 145 graduate students: 85 (3.26%) active duty, 59 (2.26%) veterans. There are 251 undergraduate students: 123 (4.72%) active duty, 128 (4.91%) veterans. It offers ABET-accredited B.S. degrees in civil engineering, electrical engineering, computer engineering, mechanical engineering, modeling and simulation engineering, and engineering technology (majors: civil engineering technology, electrical engineering technology, and mechanical engineering technology) with military and

active-duty representation in every major. See Table 1 for a breakdown of active duty and veteran students by class level and major for Spring 2023 as an example of military and veteran presence within BCET. Student veterans/military students (SVMS) are a logical population to examine when considering the critical STEM workforce and diversity needs in the United States since Norfolk, located in southeast coastal Virginia, is a highly diverse community that is within proximity to the one of the largest naval bases in the world as well as to Army, Air Force, Coast Guard, and Marine Corps bases.

Table 1: Active Duty and Veteran Engineering Students by Major, Spring 2023

Major	***Class***	***Class Count***	***Active Duty***	***Veteran***
Civil Engineering	First Year	2	1	1
	Sophomore	6	2	1
	Junior	5	5	1
	Senior	10	3	7
Civil Engineering Technology	First Year	6	5	1
	Sophomore	7	3	4
	Junior	12	8	4
	Senior	21	9	12
Computer Engineering	First Year	7	3	4
	Sophomore	8	7	3
	Junior	10	3	3
	Senior	6	3	5
Electrical Engineering	First Year	4	2	2
	Sophomore	10	3	7
	Junior	5	2	3
	Senior	23	12	11
Electrical Engineering Technology	First Year	4	1	3
	Sophomore	8	5	3
	Junior	7	3	4
	Senior	17	7	10
Mechanical Engineering	First Year	4	2	2
	Sophomore	4	1	3
	Junior	16	8	8
	Senior	21	10	11
Mechanical Engineering Technology	First Year	4	1	3
	Sophomore	7	3	4
	Junior	9	5	4
	Senior	28	11	17
Modeling & Simulation Engineering *This major is now a concentration in Computer Engineering	First Year	0	0	0
	Sophomore	0	0	0
	Junior	0	0	0
	Senior	1	0	1

This project, which began in Fall 2018, just completed its fourth out of five years. This competitive program targeted sophomores, juniors, and seniors who demonstrated academic success (3.00 GPA or higher) as well as a high financial need. After a rigorous selection process,

the principal investigators invited between 11-16 SMVS students to participate in the project each Fall and Spring semester. As part of this project, students were required to attend a professional development seminar course – ENGN 444, *Veterans in Engineering and Engineering Technology* –and were awarded a $5,000 dollar scholarship each semester for up to two years/four semesters. Within the context of this weekly one-credit hour pass/fail course, students were exposed to critical professional development topics and skills. Various guest speakers discussed different topics related to engineering, and the course addressed topics related to professional development. In addition to hearing from the various guest speakers, students learned critical professional skills including learning about the importance of different professional exams; various scholarships; how to search for internships and/or permanent positions; how to develop a cover letter, resume, and follow-up letter; how to prepare for and respond to questions during interviews; how to behave while on industrial tours/interviews; how to dress, eat, and hold professional conversations during formal meetings and meals; and how to network and follow-up after meeting people professionally.

Methods

The qualitative data for this analysis are derived from the pre-semester and post-semester focus groups that are run each semester. The six project variables (see Project Variable section) were created after the first year of the project and have been continuously examined and evaluated for necessary changes but have not had to be updated/changed to date.

Participants

To be considered for the targeted learning community, prospective participants had to fill out an application, a demographic survey, be enrolled in an engineering or engineering technology major, demonstrate high academic achievement (3.00 GPA or higher), preferably hold junior and senior standing (sophomores were also considered), and demonstrate high financial need through the Federal Application for Federal Student Aid (FAFSA). Students could apply for the course up to four times but had to meet the minimum requirements each time to qualify.

Prior to each semester, the project investigators would meet to go over the applications, determine and decide on the top qualified students, and ask them to enroll in the course. The aim was 12 students per semester, but at times, there were fewer and times there were more depending on qualification of students. Tables 2-5 show the demographic data by calendar year. In the four years offered, 53 unique students have taken the course for a total of 92 instances with students repeating the course multiple times.

Table 2: Fall 2018-Spring 2019 Demographic Data, N=23

Age	Race	Gender	Major	Fall 2018	Spring 2019
26	Black	Male	Mechanical Engineering	X	
29	White	Male	Mechanical Engineering Technology	X	X
28	White	Male	Civil Engineering	X	X
28	White	Male	Mechanical Engineering	X	X
25	White	Male	Electrical Engineering	X	X
31	White	Male	Electrical Engineering	X	X
22	Latine	Male	Mechanical Engineering	X	X
33	White	Male	Mechanical Engineering		X

26	Latino	Male	Mechanical Engineering	X	X
31	White	Male	Mechanical Engineering		X
27	Latino	Female	Mechanical Engineering	X	X
28	White	Male	Electrical Engineering	X	X
39	White	Male	Mechanical Engineering Technology	X	X

Table 3: Fall 2019-Spring 2020 Demographic Data, N=23

Age	Race	Gender	Major	Fall 2019	Spring 2020
27	White	Male	Civil Engineering	X	X
25	White	Male	Electrical Engineering	X	X
32	White	Male	Electrical Engineering	X	X
35	Black	Male	Electrical Engineering	X	X
36	White	Male	Civil Engineering	X	X
38	Latino	Male	Computer Engineering	X	
29	White	Male	Mechanical Engineering	X	X
28	Latinx	Male	Mechanical Engineering	X	
32	White	Male	Mechanical Engineering	X	X
29	White	Male	Electrical Engineering	X	X
29	White	Male	Electrical Engineering	X	X
32	White	Male	Computer Engineering		X
29	White	Male	Mechanical Engineering Technology		X
26	Latino	Male	Mechanical Engineering Technology		X

Table 4: Fall 2020-Spring 2021 Demographic Data, N=23

Age	Race	Gender	Major	Fall 2020	Spring 2021
26	Black	Male	Mechanical Engineering Technology	X	X
30	White	Male	Mechanical Engineering Technology	X	X
25	White	Male	Mechanical Engineering	X	X
29	White	Male	Mechanical Engineering	X	X
28	White	Female	Civil Engineering Technology	X	X
59	White	Male	Mechanical Engineering	X	X
27	White	Male	Mechanical Engineering	X	X
37	White	Male	Civil Engineering	X	
28	White	Male	Mechanical Engineering Technology	X	X
29	White	Male	Electrical Engineering Technology	X	X
30	White	Male	Mechanical Engineering	X	X
30	White	Male	Electrical Engineering	X	
45	White	Male	Computer Engineering	X	

Table 5: Fall 2021-Spring 2022 Demographic Data, N=23

Age	Race	Gender	Major	Fall 2021	Spring 2022
27	Black	Male	Mechanical Engineering Technology	X	X

31	White	Male	Mechanical Engineering Technology	X	X
26	White	Male	Mechanical Engineering	X	X
28	White	Female	Civil Engineering Technology	X	
22	White	Male	Mechanical Engineering	X	X
26	White	Male	Mechanical Engineering Technology	X	X
28	White	Male	Mechanical Engineering	X	X
29	White	Male	Mechanical Engineering Technology	X	X
40	White	Male	Mechanical Engineering Technology	X	X
49	White	Male	Civil Engineering	X	
30	Latine	Male	Mechanical Engineering	X	X
36	White	Male	Civil Engineering Technology	X	X
28	Multiracial	Male	Mechanical Engineering Technology		X

Researchers' Positionality

The researchers work in the Batten College of Engineering and Technology. One is an assistant dean, one is a department chair, and one is a faculty administrator. The methodologist is a faculty member in the College of Education and Professional Studies. Together, they have over 80 years of experience working with engineering and technology students and over 50 years working with military and veteran students. One researcher is a Navy veteran, the others are civilians. This may affect how we view military and veteran student needs, and we acknowledge that this may have affected how we ran the course and viewed and analyzed the data. We attempted to bracket any assumptions as possible.

Data Collection and Analysis

During the last class session of the seminar course every semester, a focus group was conducted with the participants. The major purposes of this focus group were to discern whether the seminar course helped the participants in their professional development and if so, how. Participants were asked to respond in both written and verbal forms, as a response to an open-ended question on a post survey, and as a response to a facilitated open discussion. Notes were taken and when appropriate, probing follow-up questions were asked.

Qualitative results are provided via a content analysis of comments on camaraderie, career awareness, engineering identity, professional development, engineering self-efficacy, and financial security. Participant feedback was grouped by the project variables (see Table 5) identified in Bullington et al. (2020, 2021).

Findings and Project Variables

Project participants were adults and as such formed a special population which affected the design and development of the seminar course. While the six principles of andragogy, adult learning principles (Knowles, 1970), were extensively reviewed in prior presentations and publication pertaining to this project, the six principles are briefly presented here. The first principle is *Need to Know.* This principal centers on the expectation that "adults need to know why they need to learn something before undertaking to learn it" (Knowles et al., 1998, p. 64). Adult learners tend to ask *why*, *what*, and *how* questions about what they are learning as they discern the value of what they are learning and its potential impact on their lives. The second principle is *Self-Concept of the Learner*. Knowles et al. (1998) posited that "adults have a self-

concept of being responsible for their own decisions, for their own lives" (p. 65), and as such, adult learners need autonomy; on average, they do not like being lectured at and when necessary, they prefer to learn about processes versus theories. The third principle is *Prior Experience of the Learner*. This principle pertains to adult learners' tendency to build upon their vast array of prior experiences and using these experiences to makes sense of classroom simulations, problem solving assignments, and discussions (Knowles et al., 1998). The fourth principle is *Readiness to Learn*. If adult learners find that the topics being covered are relevant to their specific needs, they are more willing to learn the materials. The fifth principle is *Orientation to Learning*. Whereas pedagogy is subject-centered, andragogy is problem-centered or centered on life situations or challenges that need to be solved. Adult learners are more willing to learn if they know they can apply this learning to their real lives. The last principle is *Motivation to Learn*. Most adult learners are extrinsically motivated to learn; however, they are also motivated intrinsically through self-pressure, goal attainment, and the desire to advance (Knowles et al., 1998).

In alignment with and in support of the six principles of andragogy, this project focused on the development of six goals or variables including the development of: 1) camaraderie, 2) career awareness, 3) engineering identity, 4) professional development, 5) financial security, and 6) engineering self-efficacy (see Table 6). Figure 1 illustrates the relationship between the source of input in developing the seminar course, the variables addressed in this project, and their relationship to the principles of andragogy.

Table 6: Topics/Variables Pertaining to Engineering and Engineering Technology Connectedness and Community (Bullington et al, 2020; Jovanović et al., 2019)

Topics/Variables	Description
Camaraderie	1. Meet other veterans. 2. Voice opinions on academic topics 3. Meet successful veteran graduates. 4. Voice opinions on challenges of academic/work/life balance 5. Voice self-motivation issues 6. Socialize with other veterans
Career Awareness	1. Become aware of various internships and scholarships. 2. Become aware of hot to evaluate internship and scholarship postings. 3. Become aware of job postings on various websites. 4. Become aware of how to evaluate job postings
Engineering Identity	1. Learn about what it is to be an engineer. 2. Learn the importance of professional certifications. 3. Identify with successful practicing engineers (veterans)
Professional Development	1. Learn how to prepare a resume. 2. Learn how to prepare for interviews. 3. Learn how to follow up after interviews. 4. Become aware of impact of social media on hiring process. 5. Learn table/dining etiquette

Financial Security	1. Can meet living expenses. 2. Can meet academic expenses
Engineering Self-Efficacy	1. Believe they belong in an engineering/engineering technology program. 2. Believe they will be successful engineers in the future

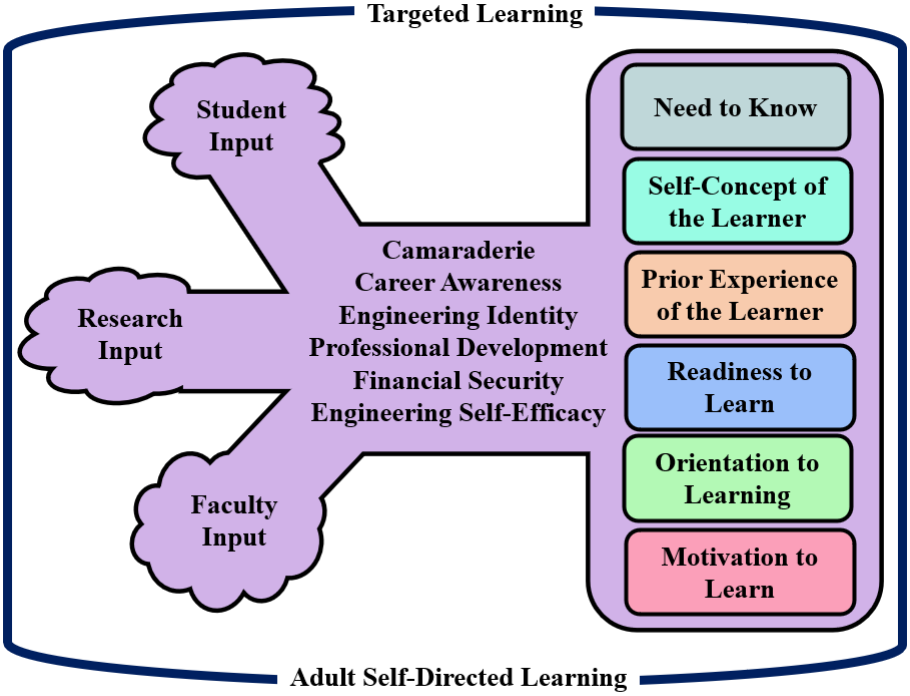

Figure 1: Targeted and Self-Directed Learning Based on Research Variables and Knowles et al.'s (2015) Andragogical Concepts (Bullington et al., 2021)

The next six sections break down findings by each of the project variables.

Camaraderie

Participants responded that having opportunities to meet people like themselves, other SVMS, was extremely important. They explained that meeting like-minded peers helped decrease their sense of isolation and expanded their social, academic, and professional networks. Participants mentioned that they appreciated the opportunity to talk about things that they would normally find difficult to talk about, especially with non-veteran students. Participants frequently mentioned that it was helpful to be able to voice the stress they were feeling when trying to balance their academic, family, and work responsibilities. Participants also mentioned that the seminar course helped them to remain motivated as they talked among themselves about courses, faculty, and looking for internships and permanent positions. Participants often mentioned that it was nice to hear from the various professional speakers that their companies targeted veterans when hiring because of veterans' levels of professionalism, maturity, and ability to communicate. One participant said, "It feels good to know that I'm not starting at the bottom." The students also mentioned that they liked hearing about different opportunities and experiences in engineering across different companies, disciplines, and functional areas.

Career Awareness

Participants frequently mentioned that they learned how to search for internships and job positions more effectively. Participants said that they learned how to look for initial positions as well as positions to which they aspire to in the future. Participants mentioned that they better understood the career paths leading to their "dream job". Participants also mentioned that the seminar course made them "think about opportunities that [they] had never thought about before."

Participants went on field trips to engineering and industrial complexes. Figure 2 shows students visiting Smithfield Foods where they were able to see aspects of food engineering, including being led on to the meat processing floor. During the field trip, they met with different types of engineers who explained their job functions.

Figure 2: A Visit to Smithfield Foods

Guest speakers had a major impact on students becoming more aware of career opportunities. One example, Daniel Hogan (Figure 2), who earned his bachelor's in Mechanical Engineering Technology from Old Dominion University and Ph.D. in civil engineering from Columbia University, is currently serving as Vice President of Design at BL Harbert International. He encouraged to students to think about graduate education and how it could serve them in the future and detailed his vast experience working internationally as an engineer.

Figure 3: ENGN 444 Students with Army Veteran, Engineer, and Old Dominion University Alumnus, Daniel Hogan.

Hearing from “people like them” who are veterans and who are engineers was cited as one of the best practices for this program. Seeing others who walked similar paths was important to our participants and hearing about the speakers’ successes and failures helped them navigate potential barriers they themselves might encounter during the job search.

Engineering Identity

Participants often spoke about how the guest speakers helped them to learn what “practicing engineers do day-to-day in the field” and what it means to be an engineer. Participants responded that guest speakers inspired them, that they became more passionate about pursuing a career in engineering after listening to them. Participants said that it was great to hear from veterans who had graduated and became successful.

Charles Southall (Figure 3), Vice President of Engineering and Design for Huntington Ingalls Industries, discussed how he led the efforts to build the U.S. Navy’s *Columbia*-class submarines. He talked about his experiences at Old Dominion University when he interned at the shipyard in the submarine program and his ascent into leadership.

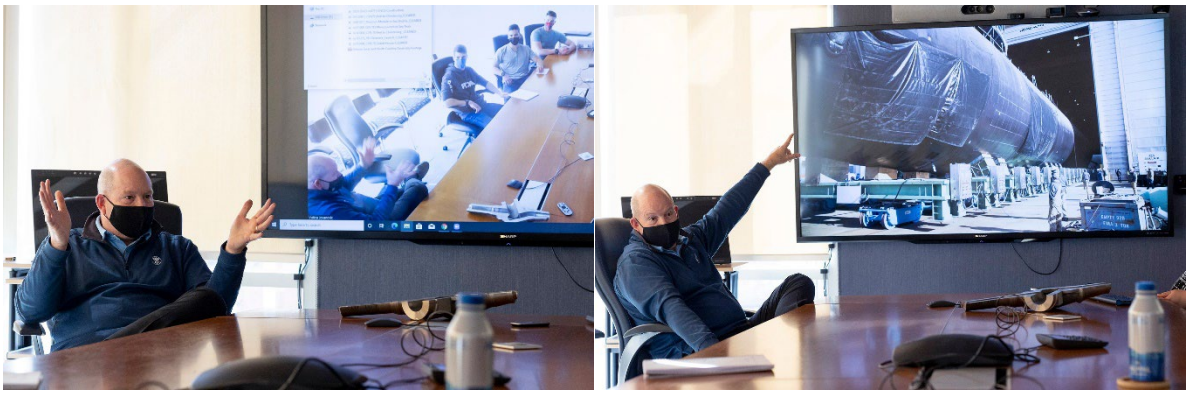

Figure 4: ENGN 444 Students with Charles Southall, Vice President of Engineering and Design at Huntington Ingalls Industries.

Professional Development

Opportunities to learn more about becoming a professional engineer was important every semester across all years. Participants overwhelmingly reported satisfaction with learning how to develop personalized cover letters and strong resumes. Participants discussed feeling better prepared for interviews because they had learned about and practiced the Situation, Task, Action, Result (STAR) interview technique (see Doyle, 2022). Participants also mentioned that they had learned how to translate their military experiences into civilian language. Participants mentioned that they appreciated the opportunity to practice proper etiquette, as well as learn how to dress for success. During one of the seminars, after a participant shared that it was difficult to remember to code switch when interviewing, participants laughed and agreed that they too were finding it difficult to remember to be more professional in their tone and style and to use less profanity and slang when interviewing.

Figure 4 shows Lourdes Spurlock, a six-year Navy veteran and Old Dominion University alumna, who spoke on her experiences transitioning to engineering as a female veteran. Female participants in the project were particularly impressed by Spurlock and her experience as a as a compliance engineer at Apex Clean Energy. (Spurlock is wearing a tiara because she recently won the *2022 United States of America’s Mrs. Virginia* competition.)

Figure 5: ENGN 444 Students with Guest Speaker, Lourdes Spurlock

Financial Security

It was clear that the $5,000 scholarship each semester helped participants address their financial concerns. While many respondents used this money to help with tuition and books, others used it to pay for childcare expenses, pay down credit card debt, and to help offset current living and other academic expenses. For those participants who no longer qualified for the G.I. Bill, the scholarship helped them get through college without having to take additional student loans. We also discussed the Edith Nourse Rogers STEM scholarship program that provides an extra 9 months or $30,000 for those who have exhausted their 36 months of benefits (U.S. Department of Veterans Affairs, 2023) as an additional financial option to help complete their degrees.

Engineering Self-Efficacy

Respondents overwhelmingly discussed being more confident about their choice to be an engineer and that felt more comfortable entering the field with the knowledge and skills provided in the seminar course. Many voiced that they were confident about being a successful practicing engineer in the future, e.g., “I believe I made the right career choice, and I chose the right program to be successful”. Having a platform to discuss their concerns allowed participants to overcome certain fears or hesitations about choosing a career in engineering; they felt more confident about having chosen engineering as their profession. Participants also mentioned that it was reassuring to see that the guest speakers had successfully transitioned from the military to college, and from college to become practicing engineers.

Discussion

Students enrolled in this program have shown increases in all six project variables (Bullington et al., 2021) and report that the program interventions are helping them navigate their pathway to an engineering career and the qualitative results derived from the focus groups affirm this past finding. All participants have either graduated or are maintaining their high GPAs as they approach graduation. Those who have graduated are employed in engineering fields and some have come back to talk to the students about their experiences.

It is important for students to talk to others who are like them and are successful in the fields they aspire to join. Having this targeted intervention, which allowed them to speak to successful engineers who are also military veterans, is a successful strategy to use. We recommend a wide variety of speakers, from age differences, race/ethnicity differences, field differences so that participants can get a breadth of experiences. Exposing aspiring engineers to the field was also

important to our participants. They enjoyed visiting engineering and industrial firms to experience what it is like on an engineering/industrial floor.

One strategy used by the researchers was to discuss scholarship, grants, paid internships, and co-ops with program participants as well as to provide links to these resources via the Canvas course website. The researchers assisted the students in writing applications for these types of programs and provided letters of recommendation in support of program participants when asked. We also partnered with our career services office to provide guest speakers on resume writing, interviewing, and applying for jobs.

Challenges

One challenge we faced was finding a time where all students were available for field trips, as the one-hour seminar was not enough for travel time and a visit. After a field visit, we would have those who were able to attend tell the others about their experiences during that visit. Another challenge was we had to ensure that we did not have the same speakers over a two-year period to avoid duplication for students. A way that we mitigated that was to provide information about former speakers so that if a speaker from an area they were interested in would not be coming back prior to a student graduating, they had that person's contact information and what they discussed during their time with us. All of our speakers were glad to share their information and wanted the students to keep in contact with them, whether as a way to pay it forward or as a recruiting tool. Even with the draw of the $5,000 scholarship and the targeted professional development skills, we did face project recruitment issues. Most of the veteran engineers we spoke to believed they were not qualified for the program or that it was so competitive they did not bother to apply; we were able to change a lot of their minds by reaching out to them individually. We believe that many institutions like ours provide the same resources that we provided to the students but the specific focus on veteran students as well as ensuring that these resources were provided in a one-stop format via the course is one way our project has been so well received by our students. Other institutions could create population-focused courses that provide resources that population needs in a format like this one. While we believe the stipend was what brought the students to the class, what they learned in the class was equally as valuable – if not more valuable – to the students as they progressed through their engineering student careers, which may be one reason that students reenrolled in the course as often as they could. A program like this could be implemented at little to no cost without the stipend. Our focus was also on high-ability, low-income students – opening this up to an entire college as a professional development seminar could be effective, especially if these seminars are targeted to the populations that need them. These targeted seminars could be any size, but we found that the smaller, more intimate format was also helpful for building camaraderie and trust.

Conclusion

Even though the GI Bill provides veterans financial benefits that they can use to pursue their education, these benefits are often not enough to complete a challenging engineering curriculum, which takes many students more than four years to complete. While immensely helpful, the 36 months of financial support that student veterans qualified for simply was not enough as many of the students had to take several lower level and prerequisite courses in community colleges to qualify and apply for to an engineering or engineering technology program at ODU. Also, as older students, many veteran students are married with children and regularly charge their expenses; many face significant credit card debt (Bullington et al., 2022). As an engineering

college, we are taking an in-depth examination of the curricula. Some of our bachelor's programs exceed the 120-credit minimum and we are striving to condense courses without affecting program quality. We have hired success coaches who help students with academic but also professional and personal advice to include personal finances, time management, and study skills. We still have work to do to help students with time-to-degree and working with our transfer pathways (to include examination of military transfer credit), but projects such as this one has brought many student voices and concerns to light, and we are listening and acting. We are the only college at the institution to allow sophomores to have internships, which allows them to have an early start to an engineering career pathway; other colleges start internships in students' junior years. Student veterans voiced that the knowledge and skill they learned in their seminar course during this project helped them to increase their career awareness, engineering and professional identities, and their professional self-confidence; that the scholarship they received helped to alleviate their financial concerns, and that the friends they made were for the long run.

Acknowledgement

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