EEC RFE: CAREER: 'Support our Troops': Re-storying Student Veteran and Service Member Deficit in Engineering through Professional Formation and Community Engagement: YEAR 5

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Introduction

There is an urgent need to recruit, retain, train, and sustain a diverse engineering workforce able to meet the socio-technical and environmental challenges of 21st century society. Together, student veterans and service members (SVSM) are a unique yet understudied group that comprises substantial numbers of those historically underrepresented in engineering based on their race, ethnicity, gender, ability, and socio-economic status [1-2]. Notably, approximately 62% of veterans are first generation students [3]. Along with their broad range of backgrounds and experience, SVSM have gained technical interests and skills, maturity and life experience, and leadership and teamwork training through their [4]. Together, these facets of "individual diversity" [5] make SVSM promising candidates for pursuing engineering education and careers well into the 21st century.

Project Goals and Work Plan

This National Science Foundation Faculty Early Career Development Program (CAREER) aims to advance full participation of SVSM, to include military veterans and those serving part-time in the Reserves or National Guard, within undergraduate engineering education and the engineering workforce. The project plan includes a

1) **Research Plan** to develop contextualized understandings about how SVSM participate, persist, and produce professional identities in engineering education; and an

2) **Education Plan** to place new understandings into practice through collaborative interest-holder development, implementation, and broad dissemination of two evidence-based resources for SVSM community building in engineering. These resources include an onboarding seminar series framework for SVSM in engineering education and a military awareness-building workshop for faculty, staff, administrators, and non-military students in engineering and STEM education more broadly.

Research Plan. The Research Plan builds from ongoing work using a longitudinal, narrative inquiry research approach and an innovative, two-strand theoretical framework that supports close interpretative examination of complex SVSM transitions and identity trajectories while maintaining an assets-based [6] (i.e., critical) perspective. The framework comprises social theories of identity [7] -[10] in one strand and critical theories, including Veteran Critical Theory [11] and Community Cultural Wealth [12], in the second strand. Using this framework we critically examine higher engineering education structures and interpretively explore SVSM professional identity development among undergraduates enrolled in engineering programs at 2- and 4- year public institutions in the western United States. The research plan is guided by two research questions (RQ):

1. How do SVSM participate and persist in undergraduate engineering education?
   a) How do personal and professional assets combine to create SVSM community cultural wealth in engineering?

b) How do SVSM negotiate educational structures to participate and persist in engineering?

2. During their undergraduate engineering education, how do SVSM produce engineering identities?
   a) How do SVSM experience transitions between military, civilian, academic, professional, and engineering related contexts?
   b) How do SVSM engage in engineering professional identity development?

Education Plan. The Education Plan draws from design-based research approaches, such as mixed methods participant assessments of developing education plan deliverables, and grounded theory methods, including constant comparative analysis and local theory generation. The Education Plan, conducted in tandem with the Research Plan, works to connect empirical data and local theory to practice by characterizing the current support structures available for SVSM in engineering and STEM and developing and implementing new evidence-based supports.

Year 5 Major Activities

Research Plan. Research Plan major activities conducted during project YEAR 5 include:

1) **Hiring and training one additional graduate student** to support scoping and systematic literature review activities;

2) **Recruiting, hiring, and training undergraduate researchers (ongoing)** to support Research Plan narrative inquiry analysis activities;

3) **Generating and analyzing narrative data** (**ongoing)** with undergraduate veterans and service members enrolled in engineering degree programs using longitudinal narrative interviews and journal entries;

4) **Refining and documenting narrative inquiry process used for analyzing narrative data** generated with undergraduate SVSM enrolled in engineering degree programs;

5) **Analyzing data and documenting results of scoping literature reviews** related to SVSM in undergraduate STEM education;

6) **Analyzing data and documenting results of systematic literature reviews** related to SVSM in undergraduate engineering education.

Education Plan. Education Plan major activities conducted during project YEAR 5 include:

1) **Refining, presenting, and assessing outcomes** of the military awareness training with institutional agents within our institutions college of engineering, and State of XX Veterans Affairs (VA) stakeholders, and the broader faculty and student participants at the national 2025 ASEE annual conference;

2) **Generating and analyzing STEM undergraduate participant data** using design-based research activities and mixed methods toward development/ refinement of an engineering/STEM onboarding seminar series framework for SVSM and other post-traditional students in engineering.

Outcomes Produced during Year 5 Major Activities

Research Plan. Research Plan outcomes produced during YEAR 5 major activities include:

1) **Preliminary narrative inquiry findings** centered on SVSM transitions, professional identity development, and community cultural wealth collaboratively developed from personal narrative journal entries and one-on-one narrative interviews;

2) **Narrative inquiry methodological process** was documented and conference paper drafted, published, and presented [13] (with undergraduate student co-author);

3) **Scoping review results complete,** scoping review preliminary results conference paper drafted, published and presented [14] and scoping review (final results) journal paper drafted (all with graduate and undergraduate student co-authors);

4) **Systematic literature review results complete** and systematic review (final results) journal paper drafted (with graduate and undergraduate student co-authors).

Education Plan. Education Plan outcomes produced during project YEAR 5 major activities include:

1) **Quantitative and qualitative participant feedback** generated and assessed from the military awareness training for institutional agents (i.e., faculty, students, and staff) and 2025 ASEE conference; a **tested script and video-recorded version** of the military awareness training delivered to our institution's Veteran Resource Office;

2) **Preliminary findings** developed from first year design-based research data generated and applied toward developing an engineering/STEM onboarding seminar series for SVSM and other post-traditional students in engineering.

Other Project-related Outcomes Produced during Year 5

1) One journal paper related to findings of graduate student's master thesis (completed during Year 3 and based on Education Plan work) revised, resubmitted, and accepted for publication [15] (with graduate student first author);

2) One journal paper related to SVSM in engineering revised, resubmitted, and accepted for publication [16] (with cross institutional co-authors, one co-author serves on project advisory board);

3) One book chapter related to the culture and experiences of SVSM in higher education published [17];

4) One book chapter related to "veteran friendly vs. veteran ready" supports accepted for publication [18];

5) One invited lecture on narrative research presented to the graduate students enrolled in the qualitative methods in engineering education course at our institution.

Significance of Year 5 Outcomes

1) Our narrative inquiry methodological process paper [13] provides one of the first *examples* of the operationalization and implementation of narrative inquiry methodology [18] with underserved student groups in engineering education. With roots in the social sciences and literary studies, narrative inquiry methodology is often misunderstood or misrepresented in the engineering education literature. Given our field's interest in narrative approaches to qualitative research, this paper provides a useful resource for engineering education researchers using narrative research approaches.

2) Preliminary results from Scoping Review of SVSM in STEM [14] suggest that the:

- SVSM literature in STEM education is highly concentrated in the discipline of engineering. Little research outside engineering or related to integrated STEM or STEM more generally. We conclude that more research on SVSM in STEM post-secondary education, particularly is needed, as these and related areas are likely to experience increasingly high demand for workers with both technical and professional skills and experience.
- SVSM in STEM literature is dominated by individual location, highly contextualized, qualitative studies, with a growing presence of mixed methods studies. While these types of studies are important and useful, we conclude that more transferable, multi-institutional, regional, and national level studies should also be conducted to understand the overarching mechanisms that affect SVSM integration and participation in STEM post-secondary education.
- While the SVSM in STEM literature has experienced a rapid increase since the 2009 enactment of Post 9/11 GI Bill, publication in this area reached a peak in 2019 and now appears to be receding. This finding suggest that STEM education researchers may be becoming less interested in this topic due to (a) fewer SVSM enrolling in post-secondary STEM education programs since 2019, and/or (b) waning federal funding for this research as result of the end of the highly publicized drawdowns. Regardless of reason, we conclude that this finding suggests that SVSM STEM education research is likely to continue to wane until such time as other conflicts and follow-on military drawdowns occur— thus perpetuating the well-established cyclical interest of higher education in SVSM that historically lag periods when peak needs occur.

3**)** Our preliminary outcome assessment of the Military Awareness Training for STEM Higher Education, conducted using a pre/post survey design administered before and after the workshop, showed that training overall is having intended positive effects on perceptions and awareness of SVSM in STEM. Additionally, our analysis has helped to pinpoint ways training improvements to increase the impact of its positive effects. Participants were asked to rate their self-identification with the following statements using a 5-point Likert scale (3 is neutral) ranging from (1) Does not describe me to (5) Describes me extremely well:

1. I understand the unique challenges facing SVSM pursuing higher education,

2. I understand effective strategies for supporting SVSM pursuing higher education,

3. I understand how I can contextually support SVSM within my role at this institution,

4. I am knowledgeable about campus and community support resources available for aiding SVSM successfully through higher education, and

5. I would participate in follow-up professional development trainings related to supporting SVSM in higher education.

If a participant selected at least one of the statements "does not describe them" or "describes them slightly well" in the post workshop survey, they are asked a free response question about how the training could better reinforce the selected principles. Findings showed that participants, regardless of pre-workshop starting point, rated themselves at least one scale higher on each question after attending the workshop. Descriptive feedback was used to refine the workshop in preparation for additional deliveries. Statistical results of pre/post survey responses will be documented and disseminated with impending IRB approval as sufficient (for statistical significance) numbers of workshop participants are trained. A refined, evidence-based workshop product (ppt slides, activity resources, and a full presentation script) were completed to allow for transfer of the workshop for use in other departments, colleges, and institutions.

Future Work

As this CAREER project completes Year 5 in the summer of 2026, our team remains focused on generating narrative data with SVSM participants and training additional student analysts to participate in the collaborative data analysis using narrative inquiry methodology and the methods-based techniques developed as part of the research plan [13]. Ongoing data generation and analysis is already resulting in the identification, categorization, and development of contextualized narrative episodes to communicate community cultural wealths of SVSM in the context of engineering education (RQ 1) to a broad (military and non-military; educational research and practice) audience. Additionally, our continuing research plan work is pointing toward the individual and idiosyncratic natures of the transition and identity development processes experienced by student veterans vs. student service members (i.e., those serving part time such as in the Reserves or National Guard) in engineering education (RQ 2). These emergent findings, which will not only describe but also differentiate the transition and identity development processes based on the nature of student military service (i.e., past full time service or ongoing part time service) and disciplinary focus of study (i.e., engineering), will add substantially to the current base of higher education literature that largely treats student "veteran" experience in higher education as a singular, monolithic, and representative of those of any/all military-connected, post-secondary student/s.

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