Board 230: CAREER: 'Support our Troops': Re-storying Student Veteran and Service Member Deficit in Engineering through Professional Formation and Community Advocacy—Year 2

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Introduction

Today, the need to recruit, retain, train, and sustain a diverse science, technology, engineering and mathematics (STEM) workforce able to meet the socio-technical challenges of 21st century society is more urgent than ever before. Together, student veterans and service members (SVSM) represent a unique yet understudied student group that comprises substantial numbers of those historically underrepresented and underserved in STEM (i.e., due to race, ethnicity, gender, social class, ability, orientation, etc.). The individual diversity reflected by SVSMs, as well as their technical interests, leadership and teamwork skills, maturity, life experience, and self-discipline, highlight SVSM as promising candidates for helping the field of engineering meet 21st century STEM workforce diversity goals [1,2].

Project Goals and Work Plan

The overall goal of this NSF CAREER project is to advance full participation of SVSM within higher engineering education and the engineering workforce via two complementary work streams: a *research plan* and an *education plan.* The innovative use of a critical theoretical perspective and longitudinal data generation approach in the research plan ensures the potential for this work to add to the current base of empirical research related SVSM in higher education, which is historically post-positivist and cross-sectional in nature and largely deficit based.

Within the *research plan*, we engage in longitudinal narrative inquiry [3] with purposefully selected [4], intersectionally diverse SVSM enrolled in undergraduate engineering and pre-engineering programs across 2- and 4- year public colleges and universities located in the western United States. Through shared story-telling, via bi-weekly journaling exercises, quarterly in-depth interviews, and ad hoc networking group meetings, we develop deep, contextualized, and nuanced understandings about how diverse SVSM participate, persist, and produce professional identities in engineering.

Research plan work is guided by two research questions (RQ) and sub-questions:

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?

In this project, we approach narrative data generated with SVSM from both critical and interpretive perspectives to develop new understandings about how SVSM experience engineering education within *public* institutions of higher education and *civilian* engineering programs. Within the first strand (RQ 1), we employ Critical Theories [5-6] (i.e., Veteran Critical Theory and Community Cultural Wealth) to identify systemic and institutional effects that are present within participants' narratives. The goal of this critical strand is to add to an emerging Veteran Critical Theory in higher education and to characterize the community cultural wealth that SVSM use, as assets, to operate within and resist systematic anti-military bias and oppression that manifests within civilian institutions of higher education and post-secondary programs in engineering [5].

Within the second strand (RQ 2), we adopt an interpretivist perspective, employing social, multi/intersectional, and professional identity theory tenets to reveal SVSM professional identity development processes within the SVSM narratives [7]. The goal of the interpretivist strand is to derive a conceptual model of SVSM professional identity development in engineering.

Within the *education plan,* we place these newer, assets-based understandings of SVSM experience in engineering into practice through collaborative development, implementation, and broad dissemination of contextualized training materials tuned to communicate with and assist a wide variety of engineering stakeholders, including students, faculty, staff, advisors, and administrators. We begin by directly engaging with institutional agents [cf. 8] (e.g., veterans resource administrators and staff and engineering college administrators, staff, and advisors) from our regional partner institutions in one-one-one, semi-structured interviews to gain current understandings of SVSM support practices and perceptions of SVSM in engineering education. We then synthesize the data and collaboratively share findings with institutional partners in a virtual convening to develop an action plan for SVSM advocacy within the U.S. western region context. Finally, we turn our focus toward development, implementation, and dissemination of assets-based training/support materials that center on military student awareness, allyship, and mentorship, using research plan findings, institutional agent data, and the action plan as guides.

Major Activities

Year 1

During Year 1 (2021-2022), the Principal Investigator (PI) hired the engineering education graduate student for the project, who completed required human subjects research and responsible conduct of research trainings. Together, we amended and refined initial research plan interview protocols and developed an interview protocol for the institutional agents in the education plan. We also refined our recruitment materials for the research plan. We attained

institutional review board (IRB) approval for our research and education plan data generation and analysis protocols and participant recruitment procedures and materials.

We initiated research plan participant recruitment procedures at five initial partnering institutions (Utah State University, Colorado State University, University of Wyoming, Washington State University, and College of Southern Idaho- the first Hispanic-Serving Institution (HSI) in the state of Idaho). Using a combination of purposive and snowball sampling [4], we engage intersectionally diverse (i.e., race/ethnicity, gender, orientation, ability, first generation status, types and branch of service, engineering disciplinary major) engineering SVSM participants in this longitudinal study. For those participants who (a) volunteer by completing the demographic screening survey, (b) are purposively selected based on demographic data, and (c) formally agree to participate by signing the informed consent document, data generation (i.e., interviews and journal entries) and analysis, as well as continued recruitment of additional SVSM participants, are ongoing. During Year 1, we had five volunteers and two participants (i.e., one White male, Air Force National Guard Servicemember studying mechanical engineering and one Bi-racial Asian female, Army National Guard Servicemember studying civil engineering) enter the longitudinal study.

We also initiated education plan participant recruitment procedures via purposive and snowball sampling [4] at our five initial partnering institutions. In Year 1, we completed nine one-on-one, semi-structured interviews (in person or virtually as required) with selected institutional agents from these institutions. Audio-recorded data transcription (using Trint web-based software) and transcription verification and deidentification are conducted soon after data is generated and data analysis via constant comparative analysis is ongoing. Emerging themes about institutional agent perspectives of current limitations to SVSM support in engineering that were developed from the interview data are presented as *Awareness vs Action*, *Ground Up vs Top Down*, and *Time and Resources* and described in a paper published in the 2022 ASEE Annual Conference proceedings [9].

Year 2

During Year 2 (2022-2023), the project team (i.e., the PI and graduate student) engaged two undergraduate student researchers from groups underrepresented in STEM (i.e., female) in project work over 10 weeks in the summer of 2022. One undergraduate researcher is studying to become a middle school science educator and one is studying to become a mathematician and high school math educator. The undergraduate researchers were funded by an NSF Research Experience for Undergraduates (REU) project that is directed by two engineering education faculty members in the USU Department of Engineering Education. In addition to providing methods-based experiential learning opportunities (i.e., conducting interviews with institutional agents, preparing qualitative data for analysis, coding interview data using constant comparative analysis techniques, collaboratively discussing research plan study participant stories, and preparing a poster for disseminating project results at the 2022 ASEE conference) related to the overall project, we worked with the undergraduate researchers on a specific research objective: to expand the narrative literature review on military students in engineering education that we

published in the 2022 ASEE Annual conference [10] into a systematic literature review and journal article. During the summer 2022 REU, we expanded the literature review data base to systematically include 33 articles following PRISMA guidelines for systematic reviews. Work on the resultant journal article is ongoing; one undergraduate researcher is continuing to collaborate with the project team on this work after the summer 2022 REU experience ended.

During Year 2, we continued data generation with current SVSM participants and SVSM participant recruitment for our research plan longitudinal study. To strengthen and help diversify our SVSM participant pool, the PI traveled to three public colleges and universities in Idaho in November 2022 to give project talks and to engage with additional institutions as potential recruitment sites. The trip resulted in adding Boise State University and Idaho State University to our undergraduate SVSM in engineering recruitment sites. Since summer 2022, our list of longitudinal study volunteers has grown to seventeen and a total of seven SVSM participants have entered the longitudinal study (Table 1).

Table 1. Demographics of Longitudinal Study Participants

	Race/ ethnicity	Gender ID	Branch/Type of service	Engineering Major	Program Year/ Age	High school to college	Other
1	White	male	Air Force National Guard	mechanical	senior 21	3 months	
2	Bi-racial/ Asian	female	Army National Guard	civil	junior 21	4 months	Military parent
3	White	male	Air Force National Guard	mechanical	freshman 19	2 months	Military family
4	White	male	Army National Guard	mechanical	sophomore 20	15 months	First generation
5	White	male	Army Veteran	civil	freshman, ~ 25+	36 months	Disability
6	Black	male	Navy Veteran	civil/ environmental	freshman 25	7 months	First generation
7	White	male	Army Reserves	biological	sophomore 21	26 months	Disability

As is often the case in qualitative research, data analysis is proceeding with participant recruitment and data generation activities [4]. We are now at the point of having sufficient data to start cross comparing participant narratives considering our theoretical frameworks. Very early and preliminary analytical trends from the narrative data are described below:

1. Veteran Critical Theory [5]: The current base of literature related to military students in higher education more often defines and reports on the experiences and outcomes of military students as a monolithic group called "Student Veterans" [10]. Our demographic recruitment data (Table 1) and participant narratives suggest that there is substantial (and currently undocumented) complexity in the demographics and experiences of military students across this currently normed group. In our work, we choose to refer to military students more

precisely. We currently use the term "Student Veterans and Service Members (SVSM)" to better reflect the complexity of military student experience.

2. Community Cultural Wealth [6, 11]: Across participant stories and discussions, we have begun to see a form of personal *resilience* (a proposed type of Aspirational Capital) and a unique military cultural *sense of humor* (a proposed type of Linguistic or Resistant Capital) that is attuned to (and tuned by) the constant struggles, dilemmas, and experiences common during military service as potential sources of community cultural wealth that military students use in engineering.

3. Identity: We have begun to note how differences in the salience and durability of student veterans' military identity and veteranness [cf. 12-13] along racial/ethnic lines may be related to racialized experiences while serving.

4. Identity: We have also begun to note how military students may have professional career interests outside of engineering and choose to pursue engineering as a "plan for now" or back-up plan. They may see themselves as having alternative and/or additional careers (e.g., aviation/pilot, architecture, film) in their lifetime. In some cases, SVSM pursue engineering or a specific engineering disciplinary major because it is the closest thing to what they want to study that they can do based on their circumstances (e.g., finances, what the school offers, desiring to be located near family).

For the education plan, we identified four additional institutional agents (including one each from Boise State and Idaho State) via purposeful and snowball sampling and completed one-on-one interviews with them. Data analysis has resulted in preliminary findings from the 13 institutional agent interviews and are described in a paper submitted for publication and presentation at the 2023 ASEE Annual Conference [14].

In addition, we have initiated collaborations with several professionals outside of engineering who regularly prepare and deliver diversity-focused awareness and inclusivity materials and trainings for academic audiences. To begin, we initiated a collaboration with the USU Inclusion Center LGBT+ & Allies Program Coordinator, who has agreed to serve as a continuing resource for developing awareness and inclusivity trainings for military students. We invited the LGBT+ & Allies Program Coordinator to our Engineering Education Department to present LGBT+ 101 Awareness training for department staff, faculty, and students. In doing so, we were able to experience first-hand many of the best practices verbally presented in our discussions. Moving forward, the USU LGBT+ & Allies Program Coordinator will serve as a valuable resource and source of feedback as we develop education plan materials.

We have also initiated collaborations with two academic professionals (one is a psychologist, and one is a sociologist) from the Salt Lake City Veterans' Administration (VA) who regularly provide military awareness training and military veterans and service member mental health resource information to academic institutions in Utah and the greater western region. In December 2022, these professionals presented their military awareness training for all USU personnel and we

were able to attend the presentation. Since that time, both have agreed to share their materials and assist us in developing military awareness trainings tailored to students and faculty/staff/administrators in the context of STEM and engineering.

Evaluation of Project Outcomes

Comprehensive evaluation of our research and research-to-practice efforts ensure that project outcomes are high quality and able to reach a variety of stakeholders in engineering. Our research plan efforts and the dissemination of our research findings benefit from the mentorship of our research advisory board, which includes scholars with expertise in narrative inquiry, critical qualitative research, and SVSM engineering undergraduates, as well as from the PI's own experience as a SVSM engineering undergraduate, military veteran, and professional engineer.

Our education plan efforts and the dissemination of research-to-practice products benefit from regular access to the expertise of an external project evaluator. Since the project started in July 2021, the PI and external evaluator have met (and continue to meet) virtually on at least a quarterly basis, to discuss education work plan progress, barriers to progress, and potential solutions to these barriers, and to receive and review the evaluator's formative and summative assessment of the education plan and deliverables. In April 2023, the external evaluator will travel to USU to meet in person with the project team (PI and graduate student). During this visit to USU, the project evaluator will also present an invited talk on project outcome evaluation to the USU engineering education department faculty and students, as well as other interested faculty and graduate students in the college of engineering. In addition, the project team (PI and graduate student) and the project evaluator will meet with the USU Veterans Resource Office Director, another key collaborator in education plan work, to discuss feedback on the progress of education plan efforts.

Dissemination

Our dissemination of research products for a variety of audiences interested in SVSM issues is ongoing. In Year 1 we published/presented four conference papers [9, 10, 11, 15] and one stand-alone conference presentation [16]. In Year 2, we have submitted two conference papers for publication/presentation [14, 17], have one book chapter accepted [18], and have one journal paper in progress.

Year 1

Year 1 publications and presentations toward research plan goals were focused on post-secondary education, student affairs, human resource development, and engineering education audiences as described in [9] and summarized below:

1. *Developing a conceptual model of SVSM professional identity development in engineering:*

Minichiello, A. and Kirchner, M. (April 2022). Theorizing military student transitions in U.S. higher education. American Education Research Association (AERA) Annual Meeting, San Diego, CA (hybrid).

Kirchner, M. and Minichiello, A. (April 2022). Socialization to support civilian professional identity development among student veterans. Academy of Human Resource Development (AHRD) Annual Conference, Arlington, VA (hybrid).

In these two works, the PI and collaborator Dr. Kirchner began initial theorizing about the unique processes military students use to negotiate professional, career-focused identities, such as in engineering, as civilians considering their military selves and veteranness. As we narratively engaged with our own experiences as full-time military servicemembers who transformed ourselves into civilian professionals, the PI and Dr. Kirchner developed a focus on understanding the process by which military student veterans "hybridize" [10] deeply embedded military identities as they turn toward civilian career paths.

2. *Synthesizing the available research literature related to SVSM in engineering:*

Wilkinson, H. and Minichiello, A. (2022). U.S. military students in civilian undergraduate engineering programs: A narrative review of the student veteran and service member literature. Proceedings of the 129th Annual ASEE Conference & Exposition, Minneapolis, MN.

In this work, the project team synthesized existing literature related to U.S. military students in undergraduate engineering programs through a systematized review methodology [19]. Our goal was to describe the current state of research and provide insights into current gaps and new directions for future research, which improves our capability to ground emerging findings in holistic understandings of what is known about the military student population in engineering. In total, we identified, selected, reviewed, and synthesized 22 articles as data in this review. Important findings related to military identity and student oppression include (a) the enduring saliency of military identities and veteranness among military students except in the case of Black students, (b) that military students often forgo use of support services, either due to accessibility issues or to a preference for keeping their military identities hidden, (c) the durability of deficit perspectives and negative stereotypes among engineering program faculty, staff, and administrators in engineering programs about military students. Important findings about military student decisions to major and engage engineering include that (d) while military experience is often considered as excellent preparation for success in engineering careers by academic faculty and administrators, military students may not see connections between their service and engineering careers before enrolling in an engineering degree program and (e) military technology applications can be used to engage military and non-military students together in engineering.

3. *Examining the experiences of SVSM in engineering from a critical perspective:*

Minichiello, A. (2022). Thinking critically about critical research with military undergraduates in engineering education. *Proceedings of the 129thAnnual ASEE Conference & Exposition,* Minneapolis, MN.

In this work, the PI considered how a critical theoretical perspective may impact research with military students in undergraduate engineering education. Critical approaches are unique in that they use knowledge developed during the research process to actively promote transformative praxis. This paper begins project work of combining, tailoring, and applying critical social theoretical frameworks for the purpose of reframing deficit perspectives of military students in engineering (research plan). This work also helps us begin to identify oppressive policies, procedures, and structures that may work against military student "success" (e.g., participation, persistence, and thriving) in undergraduate engineering programs (research plan) for the ultimate purpose of dismantling them in practice (education plan).

Year 2

Year 2 publications toward the research plan goals have focused on post-secondary education, student affairs, human resource development, and engineering education audiences as summarized below:

1. *Developing a conceptual model of SVSM professional identity development in engineering:*

Kirchner, M. and Minichiello, A. (expected 2023, Chapter Proposal Accepted). At war with ourselves: Academic professional identity development in the aftermath of military service. A. Muthanna and M. Khine (Eds). *Professional identity development: Continuing and enhancing professionalism in higher education*. Routledge.

In this book chapter for an edited volume on professional identity development in the academy, the PI and collaborator Dr. Michael Kirchner, both prior military servicemembers, collaboratively examine our own experiences reinventing ourselves as educators and academic researchers in higher education. We surmise that military culture may be unique in its ability to imbue those who participate in it with the logic and tenets to which it aspires; those who serve are known for internalizing a core military identity that, in turn, re-shapes them both personally and professionally. In this chapter, we unpack our experiences recreating ourselves—as military veterans and civilian academic professionals— in the wake of military service.

2. *Synthesizing the research literature related to SVSM in engineering:*

Wilkinson, H., Minichiello, A., Williams, V., and Donahue, T. (in preparation*).* A systematic review of literature related to U.S. military veterans and service members in undergraduate and pre-engineering programs in the United States.

In this work, the project team and REU undergraduate researchers are expanding the initial systematized narrative review published in 2022 [10] into a full systematic literature review

following PRISMA guidelines [19]. Our goals in doing so are to ensure we are including and reporting on all available literature relative to our focus on U.S. veteran and service member experience in undergraduate and pre-engineering education, and to reach a broader audience through publication of this work in a scholarly journal. Following systematic review processes, we have expanded our literature base from 22 to 33 articles included and are working to synthesize the findings from these papers prior to publication.

3. *Understanding awareness and perceptions of military students in engineering education:*

Wilkinson, H., & Minichiello, A. (expected 2023*).* WIP: Institutional agents' awareness and asset-based perceptions of military students in undergraduate engineering programs at public institutions in the western United States. *Submitted to the 130th Annual ASEE Conference & Exposition,* Baltimore, MD.

In this work in progress paper, the project team reports on preliminary findings related to the awareness and perceptions of military student experience in engineering education as identified from interviews conducted with institutional agents across partner public 2- and 4-year college and universities located in the western United States. Findings reveal marked differences in the awareness of military student presence in engineering programs, and in the level and types of support available for military students across institutions within the region. Differences in support services offered correlate with the length of time that an institutional veteran support structure (i.e., Veterans Resource Office or similar) has been in place and the availability of outside donor funds. Military awareness trainings and opportunities for professional mentorship and social networking among peers are identified as needed but lacking supports for military students across institutions. Findings undergird the need for building a regional, inter-institutional community aimed at sharing information, opportunities, and ideas for enhanced military student support, particularly in engineering, across public institutions in the U.S. West.

ONGOING WORK

As this CAREER project concludes Year 2 activities in late summer 2023, the research plan activities of the recruitment of and data generation and analysis with engineering SVSM participants through purposive and snowball sampling will continue. The PI will also continue to reach out to other public institutions offering undergraduate engineering and pre-engineering programs in the U.S. western region as needed to help us meet our SVSM participation and diversity goals. The project team continues to use the longitudinal narrative inquiry process to draw insights and understandings of the experiences of diverse SVSM as they progress through their engineering education. In Year 3, we anticipate sending deidentified narrative data and analysis excerpts to our research advisory board for their insights and feedback.

The research team will continue to work on the systematic literature review on military students in engineering, with plans to submit it for publication in 2023.

For the education plan, we anticipate that interviews with institutional agents will be concluded by the end of Year 2 and that the data analysis will be completed near the beginning of Year 3 in Fall 2023. Once analysis is completed, institutional agents from participating institutions will be invited to attend a virtual convening, where findings will be discussed. This convening will serve two purposes: a member check for the findings of data gathered with institutional agents and the initiation of a community of western public institutions who are interested in sharing promising practices for military student support. After the convening and member check is accomplished, findings will be refined based on participant feedback and used to develop of engineering/STEM focused military awareness trainings, allyship, and/or mentorship training materials as suggested by the findings. Products developed will be piloted at the PI's institution and then shared within the military student support community and nationally.

ACKNOWLEDGEMENTS

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