Military Veteran Students' Pathways in Engineering Education (Year 4)

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Abstract
This NSF Research in Engineering Education (REE)-funded project explores the experiences of student veterans in engineering (SVE) through a comparative case study across four institutions in the USA. Our research plan incorporates interviews with key informants on each campus, focus group interviews with SVEs, and in-depth SVE interviews. The theoretical framework expands Tinto's student integration model and Schlossberg's adult transition theory. This study has potential for broad systemic impact by diversifying pathways to and through engineering programs. During the first three years of the grant, we interviewed 23 key informants including professionals in student veteran success centers, financial aid, advising offices, and other student support services, conducted five focus groups with a total of 21 SVEs, and conducted individual interviews with 60 SVEs. In year 4, we focused on analyzing the interview and focus group data to provide a richer description of the experiences of military veterans who have chosen to pursue a bachelor's degree in engineering. Salient themes include leadership skills learned in military as they relate to persistence in engineering education; tensions with transitions to higher education; the intersections of student veteran roles with other facets of their identities such as first-generation status; differentiation by military branch and preparation for engineering education. We are focusing on disseminating results through journal papers and conference proceedings and presentations.

Project goals

Research on student veterans in engineering (SVEs) has been increasing. Military veterans hold promise for expanding and diversifying the engineering workforce.[1] Given their diverse backgrounds, their increasing numbers, and the growing national demand for engineering professionals, it is important to study the conditions under which student veterans pursue engineering education and the factors that support their success. Increasing the participation of veterans in engineering offers the possibility of enhancing engineering's diversity in many needed dimensions since, compared to civilian students, veterans are more likely to be older, first-generation college students, disabled, African American, or Latino. The post 911 GI bill has led to increasing numbers of veterans pursing higher education. This NSF-funded project aims to address gaps in the literature on SVEs by exploring their experiences across four institutions: University of San Diego (USD), North Carolina State University (NCSU), Purdue University, and Clemson University. The theoretical framework for our study builds on Tinto's student integration model[2,3] and Schlossberg's adult transition theory.[4,5] We also adopt an asset-based mindset for this work rather than the more typical deficit based approaches used to study marginalized populations.

In this research, we address the following research questions:

1. Why do veterans pursue a Bachelor's degree in engineering?
2. How do military experiences shape student veterans' educational experiences?
3. What are the experiences of student veterans in engineering education?
4. How do institutions support veterans in engineering education?

Major activities

To date, in addition to this paper for the ASEE 2018 NSF Grantees Poster Session, this project has yielded nine published conference papers,[6, 7, 8, 9, 10, 11, 12, 13, 14] two conference presentations for conferences in Spring 2018,[15, 16] one conference special session,[17] two conference workshop presentations,[18,19] and an informal session at the 2018 Student Veterans of America (SVA) national conference. We are especially pleased that one of our papers received the Best Paper Award in the Military and Veterans Division of the American Society of Engineering Education in 2017.[12] Additionally, during this last year of the grant several papers are being prepared for submission to different journals.

Focus Groups and Interviews at 4 campuses

In Fall 2015, focus groups were held at USD and NCSU. In Spring 2016, focus groups were held at Purdue and Clemson. Focus groups used a common format and exercises for the participants. Twenty-one SVEs participated in the focus groups.

Four pilot interviews with engineering student veterans were conducted in Spring 2015 and 2016. These interviews provided rich descriptions of the veterans' experiences and helped shape the final research protocol. A total of 60 interviews were conducted across the four research sites in Fall 2016 and Spring 2017.

Analysis of focus group data

Analysis is ongoing. All of the focus groups were transcribed. Where possible, the speaker was identified to support textual analysis by variables such as branch of service and major. The transcripts have been uploaded into Atlas.ti (a qualitative data analysis software program). Speakers are coded with their salient characteristics as they reported on their pre-qualification surveys such as military branch, sex, race, and engineering major (e.g. S1NMWEE would be the a Navy veteran who is Male, White, and an electrical engineering major sitting in the first seat at San Diego). As analysis progresses, this allows the research team to, for example, compare experiences and responses of Navy veterans to Army veterans or mechanical engineering students to electrical engineering students. Results from analysis of focus groups were presented at the 2016 ASEE conference,[9] the 2016 Frontiers in Education conference,[10] and EDUCON in March 2017.[11]

Analysis of interview data

All interview data have been transcribed, checked, and entered into Atlas.ti. Atlas.ti is used for more-in-depth analysis and coding of the data. We have also generated episode profiles for a subset of the transcripts to gain a more holistic understanding of our participants and their experiences.[20] Four members of the research team participated in a Qualitative Analysis Bootcamp in March 2017 to plan for the data analysis in Year 4. This experience provided new perspectives on approaching data analysis. Preliminary results from analysis of interview data from two institutions was presented at ASEE 2017.[12]

Several current themes are being explored including: first-generation student veterans, women veterans, and leadership.

First-Generation Student Veterans

A paper will be presented at the inaugural *Collaborative Network for Engineering and Computing Diversity (CoNECD - pronounced "Connected") Conference*.[16] The next step in the analysis it to adopt an intersectional lens to examine the research question "To what extent are FGSVEs' educational experiences shaped by their first-generation, military, and engineering identities?" This journal article is targeted for submission to the *International Journal of Engineering Education.*

Preliminary Interview Findings on First-Generation Student Veterans

From: C. Mobley, C. E. Brawner, J. B. Main, S. M. Lord, and M. M. Camacho, "Exploring the Experiences of First-Generation Student Veterans in Engineering," *Proceedings of the 2018 Collaborative Network for Engineering and Computing Diversity (CoNECD) Conference*, Washington, DC, April-May 2018.[16]

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, both to other student veterans and to first-generation students.

Women Student Veterans

A paper on women student veterans will be presented in the Military and Veterans Division for the ASEE 2018 Annual Conference.[15] A graduate student at Clemson University is leading this effort.

Preliminary Interview Findings on Women Student Veterans

From: R. C. Atkinson, C., Mobley, C. E. Brawner, S. M. Lord, J. B. Main, and M. M. Camacho, "I Never Played the "Girl Card": Experiences and Identity Intersections of Women Student Veterans in Engineering," *Proceedings of the 2018 American Society for Engineering Education Annual Conference*, Salt Lake City, UT, June 2018.

To improve opportunities for women student veterans in engineering (WSVE), our qualitative study contributes to the body of knowledge about women SVEs and female gender identity in engineering. Our research presents information about WSVEs' pathways into engineering and begins to unpack the factors related to WSVEs' gender, military and engineering identities.

The research was guided by three main questions:

1. Why do WSVEs pursue a Bachelor's degree in engineering?
2. How do military experiences shape WSVEs' educational experiences?
3. To what extent are the WSVEs' current engineering education experiences shaped by their gender, veteran, and engineering identities?

We interviewed seven WSVEs about their transition out of the military and into engineering programs at four institutions. Participants also completed an identity exercise articulating the extent to which various components of their identity were most central to their core self (e.g., woman, engineering student, socioeconomic status, veteran or military status, etc.).

The analysis of the participants' narratives reveals several themes: (1) there is often a connection between WSVEs' military occupational specialty (MOS) and their decision to pursue an engineering degree program; (2) their military experiences served to support their academic experiences in engineering; (3) they do not directly indicate that gender identity is particularly salient to their military experience or in engineering; however, their narratives illuminate how they conceptualize engineering identity as central to their experiences; and (4) although participants did not indicate that gender was central to their identities and experiences, nearly all of them discussed relational elements, including the significance of relationships and caregiving to their educational experiences. That is, family roles (e.g., daughter, wife, sister) were central to their identity, even if the women did not say that gender, per se, was salient.

Our initial results offer insights into the unique experiences of women who served in the military and who then chose to advance their careers and education in engineering. Policies and programs for WSVEs should account for previous military experience related to engineering, the similar male-dominated cultures both the military and engineering fields possess, and the importance of family- and relationship-oriented responsibilities to WSVEs.

Leadership
A manuscript on leadership and engineering education for SVEs is in preparation.

Preliminary Interview Findings on Leadership

From: J. B. Main, S. Lord, M. Camacho, C. Brawner, and C. Mobley, "The Translation of Leadership Skills across Domains: How Military Leadership Training and Experiences are Enacted in Engineering Education," in preparation for the *International Journal of Engineering Education* or the *Sage Journal of Leadership.*

Based on individual interviews with 12 student veterans pursuing bachelor's degrees in engineering across four institutions, we present three findings relating military leadership and its application to engineering education: (1) How leadership skills are learned, (2) Motivation to be a leader, and (3) Translation and enactment of military leadership skills into engineering education. The interviews show that leadership skills and experiences acquired in the military play an important role in the academic success of student veterans in engineering (SVEs). Findings can help inform strategies and programs to encourage more SVEs to participate in engineering education and to help them translate their leadership skills to an academic setting. Providing leadership opportunities for SVEs in the classroom has the potential to increase their engagement in engineering and to strengthen their pathways to professional engineering practice.

Advisory Board meeting

Our distinguished External Advisory Board (EAB) includes a recent student veteran engineering graduate, an engineering faculty member who has done research on supporting student veterans, a researcher from the Purdue Military Family Research Institute, a retired Marine Corps Major General who has been active in the national leadership of the Student Veterans of America (SVA), and a retired Marine Corps veteran who has been involved in various educational programs including the Voluntary Education Programs, Transition Assistance Programs, and the State of California Governor's Troops to College Program. The EAB has been very helpful in working with us to inform and refine our method and analysis.

An in-person meeting was held on the USD campus in San Diego, CA on June 19, 2017. Before this annual meeting, the research team prepared and distributed an annual report. In 2017, in response to a request from the EAB, two members of the research team also presented a PowerPoint overview of the project status and results so far. The EAB felt this was helpful for them to quickly understand what the team had accomplished, to ask focused questions of the research team, and to understand the research team's next steps. Our process might be helpful for other research teams to consider particularly if working with advisory boards that include members from outside academia.

Project team meetings
Our research team meets biweekly via teleconference to plan, coordinate, and discuss the project. All members of the project team attended the EAB meeting in June 2017, either in person or through audio conferencing.

Dissemination

We have continued with the dissemination of research results in a variety of venues for a diversity of audiences including engineering educators in the US, engineering educators from across the world, student affairs administrators who work with veterans, and the general public.

We have presented papers at several engineering conferences including the Frontiers in Education (FIE) conference in 2015 and 2016, the American Society for Engineering Education (ASEE) conference in 2015, 2016, and 2017. This included presenting a paper in the inaugural ASEE Military and Veterans Division and receiving the Best Paper Award during the Division's second year.[12] In addition, one of our team participated in a panel for this division.[21]

We are presenting a special session entitled "Answering the How and Why Questions with Qualitative Research" and a paper to the inaugural CoNECD conference.[22] CoNECD is a collaboration among:

- WEPAN - Women in Engineering ProActive Network
- NAMEPA - National Association of Multicultural Engineering Program Advocates
- MIND - Minorities in Engineering Division of the American Society for Engineering Education
- WIED - Women in Engineering Division of the American Society for Engineering Education

The special session is similar to one presented at the EDUCON conference in Athens, Greece to an international audience of engineering educators. We have also reached out to a different audience with interests in serving veterans by presenting an informal session at the 2018 SVA national conference and workshops at the 2016 and 2017 NASPA Veterans Conferences.[18,19] NASPA is an association for Student Affairs Administrators in Higher Education. In addition, members of the research team have published an OpEd and been quoted in the ASEE Prism magazine about this work.[23, 24]

Our workshops and special session included lessons learned from the qualitative methodology developed for this research. These presentations have been well received with many participants asking for more information about the project and methods. Thus we decided to share our methods more broadly by preparing a manuscript about our innovative methods for a journal on methods.[25] We are currently determining the best venue for this work. The manuscript focuses on two graphic elicitation methods that we developed and used in our in-depth interviews of student veterans in the US: the key event timeline and the identity circle. The resulting data offers rich and deep description beyond what could be captured through traditional in-depth interviews. These methods allowed participants to construct their own narratives about their experiences and helped elicit counter-narratives that challenge prevailing assumptions about what it means to be a veteran in higher education. These methods can be useful to qualitative researchers studying other marginalized populations and can help the field of veteran studies move from a deficit-based focus to an asset-based focus.

As a result of conversations between the USD Veterans Coordinator and one of our research members, the Shiley-Marcos School of Engineering was the first academic unit at USD to have a "Military Ally" workshop designed to build understanding and capacity for working with veteran students. About 20 engineering faculty and staff attended a four-hour session over two days in Fall 2016.

The following activities were not part of the original research plan but have been included largely in response to suggestions from the EAB and have been beneficial for our work.

- A research team member attended the 2017 Student Veterans of America (SVA) meeting in Anaheim, CA and found it very valuable to understand the formal and informal support structures offered by the SVA, as well as gleaning comparative institutional programming that supports veteran students at universities across the country. She met with Dr. Chris Cate, Vice President of Research for SVA, to discuss innovative possibilities for veteran students majoring in engineering. We have read the papers published through the Million Records Project and have cited this work in our papers.
- A research team member accepted EAB member Col. Roberts's invitation to visit the Marine base in Miramar. She met with Transition Assistance Program (TAP) educators and reviewed the current TAP curriculum to better contextualize our findings. Two research team members also conducted a phone interview with the educational liaisons at the 29 Palms base regarding recent changes to the TAPS program. The team also reviewed the law and documents provided regarding TAP/TAMP.
- Two research team members attended the 2018 Student Veterans of America (SVA) meeting in San Antonio, TX and, with EAB member Maj. Gen. Lehnert, led a discussion with student veteran STEM majors to share and validate our findings regarding the experiences of engineering students at our four study institutions.

Future Work

For the next year, the project team will continue biweekly conference calls and plans to continue on the schedule of activities for this project. The research team plans to hold an in-person meeting in Summer 2017. The focus of these efforts will be preparation of journal articles for dissemination.

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