Military Veteran Students' Pathways in Engineering Education (Year 3)

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Abstract

This project explores the experiences of student veterans in engineering through a comparative case study across four institutions: University of San Diego (USD), North Carolina State University (NCSU), Purdue University, and Clemson University. Our research plan incorporates content analysis of academic policies that student veterans encounter, interviews with key informants on each campus, focus group interviews with student veterans, and in-depth student interviews to elicit rich narratives. This study has potential for broad systemic impact by diversifying pathways to and through engineering programs.

During Year 1 (2014-2015) of the grant, we interviewed 23 key informants at our institutions. Key informants include professionals supporting veterans in student veteran success centers, financial aid, advising offices, and other student support services. We identified themes that shape student veteran experiences on these campuses: the presence/absence of key student policies and services; and gaps in the provision of such services. At each institution, there has been a heightened emphasis on improving services for veterans.

In Year 2 (2015-2016), we conducted five focus groups with a total of 21 student veterans engineering students. Participants who had significant technical responsibilities as part of their service often considered engineering to be a logical next step in their career. However, veterans with less technical responsibility in their military jobs were more attracted to engineering by financial opportunities and/or job security. Veteran students' relationships with faculty and other students are influenced by their age and their veteran status. While many veterans viewed age as an advantage in engineering study, some cited balancing school with the family and work responsibilities that often come with age as a disadvantage. Veterans are more likely to tell their professors than other students about their veteran status.

In Year 3 (2016-2017), we conducted 62 individual interviews with veteran engineering students at our four campuses. Data from these interviews will be analyzed and compared with data from the focus groups to provide a richer description of the experiences of military veterans who choose to pursue a bachelor's degree in engineering.

Project goals

Military veterans hold tremendous promise for expanding and diversifying the engineering workforce.[1] Given the diverse backgrounds of veterans, their increasing numbers, and the growing national demand for engineering professionals, the timing is ideal to study the conditions under which student veterans pursue engineering education and the factors that offer them the greatest support for 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. Yet, little is known regarding the educational pathways and experiences of student veterans into engineering. This project therefore aims to address gaps in the literature on student veterans in engineering through a comparative case

study across four institutions: University of San Diego (USD), North Carolina State University (NCSU), Purdue University, and Clemson University. The theoretical framework builds on Tinto's student integration model[2,3] and Schlossberg's adult transition theory.[4,5]

The following research questions are addressed:

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 2017 NSF Grantees Poster Session, this project has yielded seven conference papers[6, 7, 8, 9, 10, 11, 12], one conference special session[13], and two conference presentations.[14,15]

Focus Groups at 4 campuses: To recruit student veterans in engineering for the focus groups, we sent invitation e-mails with a link to an online qualification survey. This survey provided background information about the student veterans and allowed us to select participants for the focus groups. Feedback from our External Advisory Board (EAB) helped us to shorten the survey and to use appropriate military terminology. The survey was entered into Qualtrix and customized for each campus as the focus groups were scheduled. 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.

Analysis of focus group data. Analysis is ongoing. Results from early analysis were presented as a Work in Progress paper at the Frontiers in Education conference in October 2016.[6] The research team met at the end of June 2016 during the ASEE conference for an intensive planning and analysis session. All of the focus groups have been transcribed and where possible, the speakers have been identified so that textual analysis can be made by branch of service and major, among other things. The transcripts have been uploaded into Atlas.ti (a qualitative data analysis software program) and speakers will be identified with their salient characteristics as they reported on their pre-qualification surveys. As analysis progresses, this will allow the research team to, for example, compare experiences and responses of Navy veterans to Army veterans or mechanical engineering students to electrical engineering students.

Preliminary Focus Group Findings

From: C. E. Brawner, C. Mobley, J. B Main, S. M. Lord, M. M. Camacho, "Exploring the Intersection of Veteran Status, Age, and Engineering Study," *Proceedings of the 2016 Frontiers in Education Conference,* Erie, PA, October 2016.7

This work has shown that for military veterans who had significant technical responsibilities as part of their service, engineering is a logical next step in their career. The training that they received gives them a practical understanding of undergraduate engineering classwork that many of their non-veteran peers lack. Recruitment campaigns that target separating service members in those sorts of jobs could diversify engineering education with veteran students and yield many future engineers. Service members with less technical responsibility in their military jobs may be more attracted to engineering by messages related to financial opportunities and job security in engineering fields.

Veteran students' relationships with faculty and other students are influenced in large part by their age in addition to their veteran status. These veterans are more likely to proactively tell their faculty members about their veteran status than they are to tell other students. Most of the veterans also considered their service to be an advantage in engineering study because of their prior training, where applicable, and because of the discipline that was instilled in them during their service. While age was also considered an advantage in engineering study for many participants, balancing school duties with the family and work responsibilities that come with age was considered a disadvantage for some.

From: C. E. Brawner, M. M. Camacho, J. B. Main, C. Mobley, and S. M. Lord, "Transitioning from Military Service to Engineering Education," *Proceedings of the IEEE Global Conference on Engineering Education (EDUCON)* Athens, Greece, April 2017.[10]

Drawing on focus group data, we explore transition issues faced by student veterans as they move from the military to higher education to pursue their undergraduate engineering degrees. We consider transition from the military and transition to the university, focusing on institutional policies and practices, co-curricular supports, and the relationship between service experiences and engineering study.

The military has two things in common with undergraduate higher education: (1) a large portion of their population is between the ages of 18 and 24, and (2) they are responsible for helping their constituents move successfully to the workforce or further education. Few other entities have this transition focus as part of their mission. Yet, helping service members successfully transition to civilian life is part of the promise made to young people in exchange for serving their country.

Our focus group participants indicated that at the time most of them left the service, information and guidance about pursuing higher education was lacking. The military has recently made changes to the mandatory transition assistance programs to make them more relevant, both to service members seeking employment and those aspiring to further their education. The connection between certain military specialties and engineering study may be obvious to many in academia, but perhaps is less so to those who are serving in areas such as electronics technician, explosive ordnance disposal, and nuclear machinist. It appears service members in the Navy nuclear power program are receiving specific encouragement to pursue engineering degrees, both through an enlisted-to-officer program and through a command structure that encourages people in those fields to pursue engineering education after they complete their military obligation. Participants who served in technical fields in other branches of the service did not report the same level of encouragement to pursue an engineering degree, more often coming to that conclusion on their own, perhaps with some personal, rather than systemic, guidance from within their command. The

military could expand the educational prospects of many of their technical personnel by providing more proactive information regarding opportunities in engineering.

Academically, the transition to engineering education was relatively easy for most of the focus group participants because their prior training in technical fields provided them a basic understanding of engineering concepts and principles. Students without a technical background still found that the discipline and other personal characteristics instilled in them through their service was an asset that contributed to their academic success.

Many of our focus group participants indicated that working in groups during their engineering education posed some challenges. Although working in groups is a critical skill that is well honed in the military, some of the veterans found it challenging in academia because of their different approach to group projects relative to traditional students, specifically their desire to get to work as soon as possible to complete the task rather than putting it off until the last minute, as traditional students may be inclined to do.

Social transitions vary based on veterans' networks. Some veteran students found camaraderie with other veterans through various channels, such as veteran-specific orientation, student veterans' organizations, and veterans' resource offices. Yet others either did not find these organizations inviting or were not interested in participating in these organizations as they wanted to put their service time behind them.

Responsibility for sharing this information extends beyond the military. Colleges of engineering, as part of their recruiting and outreach to military veterans, can adjust how they inform future students about the various courses of study. Clarifying the connections between technical experience and academic engineering education would help veterans identify with these fields. Then, institutions can welcome the veterans to campus through veteran-specific outreach and advising.

In-depth student interviews at four campuses: 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. Interviews were conducted at all four research sites throughout Fall 2016 and completed in Spring 2017. A total of 62 interviews have been completed. Preliminary results from analysis of interview data is being presented at ASEE 2017.[12]

Preliminary Interview Findings

From: C**.** Mobley**,** M. M. Camacho, S. M. Lord, C. Brawner, and J. B. Main. "Entering the Engineering Pathway: Student Veterans' Decision to Major in Engineering." *Proceedings of the American Society of Engineering Education Conference*, Columbus, OH, June, 2017.[12]

In this work, we draw upon in-depth interviews conducted with student veterans in engineering (SVEs) at two of our four study institutions to: (1) better understand the factors that shape SVEs' decisions to major in engineering and, (2) determine whether and how the military influences student veterans' decisions to major in engineering. Our work provides insights into the timing of the decision as well as the extent to which military training and experiences provide a direct, or indirect, pathway into engineering.

We highlight student narratives to advance knowledge about SVE's educational pathways on several fronts. Methodologically, our in-depth analysis allows us to capture the nuanced nature of SVE narratives that often remain hidden when using other approaches to studying engineering education. Theoretically, we draw from Cognitive Information Processing theory to more accurately reflect SVE decision making about majoring in engineering. Practically, the results can inform military transition assistance programs and improve university efforts to ensure that student veterans experience a successful transition from their military career to higher education and engineering studies.

This work focuses on two research questions. For Research Question # 1 "What are some broader influences on the decision to major in engineering?" three themes emerged from our data. Theme 1: Decision to major in engineering was made prior to military service. Theme 2: Decision to major in engineering was prompted through the encouragement from other individuals. Theme 3: Decision to major in engineering shaped by concerns about financial security. For Research Question # 2: "To what extent did the military influence the decision to major in engineering?" two themes emerged from our analysis. Theme 1: Military experiences influenced the decision to major in engineering. Theme 2: Military experiences did not have a direct influence on the decision to major in engineering.

Advisory Board meeting: A conference call was held in January 2016 and an in-person meeting was held in San Diego, CA on the USD campus on June 17, 2016. We have worked extensively with our distinguished External Advisory Board (EAB) which 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 Marine Corps veteran who is an adjunct engineering instructor, 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 worked with us to inform and refine our method and analysis

Project team meetings: Our research team has been meeting biweekly via teleconference to plan, coordinate, and discuss the project elements. Our team met in person in June 2016 in New Orleans, LA during the ASEE Annual Conference followed by a joint meeting with the research team and EAB later in June 2016 in San Diego, CA. All members of the project team attended with some calling in.

Dissemination:
We have continued with the dissemination of research results. We have presented papers at several engineering conferences including the Frontiers in Education (FIE) conference in 2015[6] and 2016[7] and the American Society for Engineering Education (ASEE) conference in 2015 and 2016.[9] This included presenting a paper in the inaugural ASEE Military and Veterans Division.[11] In addition, one of our team participated in a panel for this division.[16]

We also reached out to a different audience with interests in serving veterans by presenting a workshop at the NASPA Veterans Conference in February 2016 in Orlando, FL[14] and February 2017 in Washington, DC.[15] NASPA is an association for Student Affairs Administrators in Higher Education. The presentations were well received and we have begun to collect the names and e-mail addresses of individuals who are interested in our study findings. In addition, a member of our research team also presented a poster at the Southern Sociological Society in April 2016[17] and at a college-level research symposium at Clemson University. Several other faculty members from Clemson who are conducting research on student veterans expressed interest in learning more about our project.

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 will be spending four days together in March 2017 to begin in-depth analysis of the study data in anticipation of Year 4 when we will submit papers to peer-reviewed journals. We also plan to hold an in-person meeting in Summer 2017. We are also presenting our work in a presentation and special session at the *IEEE Global Conference on Engineering Education (*EDUCON) in April 2017.[11,13]

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REFERENCES

1 National Science Foundation. (2009). *Veterans' Education for Engineering and Science*, Report of the NSF Workshop on Enhancing the Post-9/11. Veterans Educational Benefit, McLean, Virginia, April 13, 2009.

2 V. Tinto. (1975). Dropout from higher education: A theoretical synthesis of recent research. *Review of Educational Research*, *45*, 89-125.

3 V. Tinto. (1993). *Leaving college: Rethinking the causes and cures of student attrition.* (2nd ed.). Chicago: University of Chicago Press.

4 N. K. Schlossberg. (1981). A model for analyzing human adaptation to transition. *Counseling Psychologist, 9*(2), 2-18.

5 N. K. Schlossberg. (1984). *Counseling adults in transition.* New York, NY: Springer Publishing.

6 C. Brawner, C. Mobley, S. Lord, J. B. Main, and M. Camacho, "Work in Progress: The institutional environment for student veterans in engineering," *Proceedings of the 2015 Frontiers in Education Conference*, El Paso, TX, October 2015.

7 C. E. Brawner, C. Mobley, J. B Main, S. M. Lord, M. M. Camacho, "Exploring the Intersection of Veteran Status, Age, and Engineering Study," *Proceedings of the 2016 Frontiers in Education Conference*, Erie, PA, October 2016.

8 J. Main, C. Brawner, M. M. Camacho, S. M. Lord, and C. Mobley, "Exploring Military Veteran Students' Pathways in Engineering Education," *Proceedings of the 2015 ASEE Conference*, Seattle, WA, June 2015.

9 S. Lord, C. Brawner, C. Mobley, J. B. Main, and M. Camacho, "Military veteran students' pathways in engineering education (Year 2)," *Proceedings of the 2016 ASEE Conference*, New Orleans, LA, June 2016.

10 J. B. Main, C. Mobley, C. Brawner, S. Lord, and M. Camacho, "Using focus groups to understand military veteran students' pathways in engineering education. *Proceedings of the 2016 ASEE Conference*, New Orleans, LA., June 2016.

11 C. E. Brawner, M. M. Camacho, J. B. Main, C. Mobley, and S. M. Lord, "Transitioning from Military Service to Engineering Education," *Proceedings of the IEEE Global Conference on Engineering Education (EDUCON)* Athens, Greece, April 2017.

12 C. Mobley, M. M. Camacho, S. M. Lord, C. Brawner, and J. B. Main. "Entering the Engineering Pathway: Student Veterans' Decision to Major in Engineering." *Proceedings of the 2017 ASEE Conference*, Columbus, OH, June 2017.

13 S. M. Lord, M. M. Camacho, C. E. Brawner, C. Mobley, and J. B. Main, "Have You Ever Wondered Why? Qualitative Research Methods to Investigate Engineering Education," *Proceedings of the IEEE Global Conference on Engineering Education (EDUCON,)* Athens, Greece, April 2017.

14 C. Mobley, C. E. Brawner, S. M. Lord, J. B. Main, and M. M. Camacho, "Student Veterans in Engineering: Advancing Knowledge about Student Veterans in the Disciplines." Workshop presented at the *Annual Meeting of the National Association of Student Personnel Administrators (NASPA)*, Orlando, FL, February, 2016.

15 C. E. Brawner, C. Mobley, S. M. Lord, J. B. Main, and M. M. Camacho, "Digging Deep: Using Qualitative Research to Uncover the Stories of Student Veterans," Workshop presented at the *Annual Meeting of the National Association of Student Personnel Administrators (NASPA)*, Washington, DC, February, 2017.

16 M. Williams, K. Landry, J. B. Main, T. Dean, and K. J. Ratliff, "Panel: Supportive Pathways to ETETE for Veterans and Military Students," *2016 ASEE Annual Conference*, New Orleans, LA, June 2016.

17 C. E. Brawner, C. Mobley, S. M. Lord, J. B. Main, and M. M. Camacho, "Multiple Identities and Multiple Experiences: A Sociological Investigation of Student Veterans in Engineering." Poster presented at the *Annual Meeting of the Southern Sociological Society*, Atlanta, GA, April 2016.