

## **Board 94: Military Veteran Students' Pathways in Engineering Education (Year 5)**

### **Dr. Susan M Lord, University of San Diego**

Susan M. Lord received a B.S. from Cornell University and the M.S. and Ph.D. from Stanford University. She is currently Professor and Chair of Integrated Engineering at the University of San Diego. Her teaching and research interests include inclusive pedagogies, electronics, optoelectronics, materials science, first year engineering courses, feminist and liberative pedagogies, engineering student persistence, and student autonomy. Her research has been sponsored by the National Science Foundation (NSF). Dr. Lord is a fellow of the ASEE and IEEE and is active in the engineering education community including serving as General Co-Chair of the 2006 Frontiers in Education (FIE) Conference, on the FIE Steering Committee, and as President of the IEEE Education Society for 2009-2010. She is an Associate Editor of the IEEE Transactions on Education. She and her coauthors were awarded the 2011 Wickenden Award for the best paper in the Journal of Engineering Education and the 2011 and 2015 Best Paper Awards for the IEEE Transactions on Education. In Spring 2012, Dr. Lord spent a sabbatical at Southeast University in Nanjing, China teaching and doing research.

### **Prof. Michelle M. Camacho, University of San Diego**

Michelle M. Camacho is Professor of Sociology at the University of San Diego. She began her career at UC San Diego in 1999 as a postdoctoral fellow at the Center for US Mexican Studies, and later as a UC Faculty Fellow in Ethnic Studies. In 2015-16, she returned to UC San Diego as a fellow of the American Council on Education. As a bilingual/bicultural Latina, Camacho has 30 years of experience in higher education advocating for underrepresented groups and first generation college students. For over a decade, her work on institutional transformation has received funding from the National Science Foundation to examine and address inequities in higher education, specifically as they relate to Science, Technology, Engineering and Mathematics (STEM). She served the NSF ADVANCE grant initiatives as a co-Principal Investigator, working to improve practices to recruit and retain women of color in STEM and enhance institutional climate at USD. Other current research grants support pathways for veterans in higher education, and the NSF program called, "Revolutionizing Engineering & Computer Science Departments." Her co-authored books include *The Borderlands of Education* (with Susan Lord), *Mentoring Faculty of Color*, and *Beginning a Career in Academia: A Guide for Graduate Students of Color*. She is past-Vice President (2017) of the Pacific Sociological Association, and an appointed consultant to the American Sociological Association's Departmental Resources Group. Fluent in both quantitative and qualitative research methodologies, her research uses theories from interdisciplinary sources including cultural studies, critical race, gender and feminist theories. Central to her work are questions of culture, power and inequality. She is affiliated faculty with the Department of Ethnic Studies, Women's and Gender Studies, and Latin American Studies.

### **Dr. Catherine E. Brawner, Research Triangle Educational Consultants**

Catherine E. Brawner is President of Research Triangle Educational Consultants. She received her Ph.D. in Educational Research and Policy Analysis from NC State University in 1996. She also has an MBA from Indiana University (Bloomington) and a bachelor's degree from Duke University. She specializes in evaluation and research in engineering education, computer science education, and technology education. Dr. Brawner is a founding member and former treasurer of Research Triangle Park Evaluators, an American Evaluation Association affiliate organization and is a member of the American Educational Research Association and American Evaluation Association, in addition to ASEE. Dr. Brawner is also an Extension Services Consultant for the National Center for Women in Information Technology (NCWIT) and, in that role, advises computer science and engineering departments on diversifying their undergraduate student population. She remains an active researcher, including studying academic policies, gender and ethnicity issues, transfers, and matriculation models with MIDFIELD as well as student veterans in engineering. Her evaluation work includes evaluating teamwork models, broadening participation initiatives, and S-STEM and LSAMP programs.

**Dr. Joyce B. Main, Purdue University-Main Campus, West Lafayette (College of Engineering)**

Joyce B. Main is Assistant Professor of Engineering Education at Purdue University. She holds a Ph.D. in Learning, Teaching, and Social Policy from Cornell University, and an Ed.M. in Administration, Planning, and Social Policy from the Harvard Graduate School of Education.

**Dr. Catherine Mobley, Clemson University**

Catherine Mobley, Ph.D., is a Professor of Sociology at Clemson University. She has over 30 years experience in project and program evaluation and has worked for a variety of consulting firms, non-profit agencies, and government organizations, including the Rand Corporation, the American Association of Retired Persons, the U.S. Department of Education, and the Walter Reed Army Institute of Research. Since 2004, she has been a member of the NSF-funded MIDFIELD research project on engineering education; she has served as a Co-PI on three research projects, including one on transfer students and another on student veterans in engineering.

# **Military Veteran Students' Pathways in Engineering Education (Year 5)**

## **Abstract**

This NSF Research in Engineering Education (REE)-funded project explores the experiences of student veterans in engineering (SVE) at four institutions across the US. Data collection included interviews with key informants in year one of this grant, focus groups with SVEs in year two, and in-depth SVE interviews in year three at each campus. Years 4 and 5 have focused on analysis and dissemination. Here, we provide a summary and highlight some results from our work. This study has potential for broad impact by diversifying pathways to and through engineering programs.

## **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 9/11 GI bill has led to increasing numbers of veterans pursuing higher education. This NSF-funded project addresses 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?

## **Data Collection and Analysis**

At each of our four campuses, we conducted interviews with key informants in year one of this grant, focus groups with SVEs in year two, and in-depth SVE interviews in year three. Overall, we have data from 25 key informants, 21 focus group participants who were SVEs, and 60 interviews with SVEs.

All recorded data were transcribed, checked, and entered into Atlas.ti, a qualitative data analysis software program used for in-depth analysis and coding. For focus groups, where possible, the speaker was identified to support textual analysis by variables such as branch of service and

major. Speakers are coded with their salient characteristics that they reported on their pre-qualification surveys such as military branch, sex, race, and engineering major (e.g. S1NMWEE would be 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. For interview data, we generated episode profiles for a subset of the transcripts to gain a more holistic understanding of our participants and their experiences [6].

## **Dissemination**

During year five, we have continued with the dissemination of research results in a variety of venues for a range of audiences including engineering educators in the US, engineering educators from across the world, student affairs administrators who work with veterans, the Student Veterans Association (SVA), and the general public [7, 8].

In addition to this paper for the 2019 American Society for Engineering Education (ASEE) Annual Conference NSF Grantees Poster Session, this project has yielded two published journal articles [9, 10] and thirteen published conference papers [11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23]. We did a presentation at the 2019 CoNECD conference in April 2019 [24] and have two papers for the ASEE conference in June 2019 [25, 26]. We have presented a poster [27], two conference special sessions [28, 29] and three workshops [30, 31, 32]. We delivered an informal session at the 2018 SVA national conference and a presentation at the 2019 Annual Meeting of the Pacific Sociological Association [33]. We presented a paper in the inaugural ASEE Military and Veterans Division and received the Best Paper Award during the Division's second year [17]. In addition, one member of our team participated in a panel for this division [34]. We are currently working on several manuscripts for journals.

### *Sharing insights from our methods*

During the course of this work, we developed two innovative methods for data collection: the key event timeline and the identity circle. 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. The resulting data offer rich and deep description beyond what could be captured through traditional in-depth interviews. 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.

We have shared these methods including lessons learned with multiple audiences through workshops and special sessions at EDUCON [28], CoNECD [32], and the NASPA Veterans conferences [30, 31]. NASPA is an association for Student Affairs Administrators in Higher Education. Most recently, we presented a session entitled "Special Session: Taking a Deep Dive: Qualitative Methods and Identity," at the 2018 Frontiers in Education (FIE) conference [29].

Because these presentations have been well received with many participants asking for more information, we decided to share our methods more broadly through a paper about our innovative methods for a qualitative methods journal [35].

## **Findings**

Our analysis has focused on several areas including leadership, first-generation student veterans, Black student veterans, gay student veterans, campus allies and advocates, and how military branch may impact student veterans' choosing engineering.

### ***Leadership***

Based on our interview data, we examined how SVEs enact their military leadership training and experiences in engineering education. An article on this topic appeared in the second issue of 2019 in the *International Journal of Engineering Education* [10].

#### ***Findings on Leadership***

From: J. B. Main, M. M. Camacho, C. Mobley, C. Brawner, S. M. Lord, and H. Kesim, "Technically and Tactically Proficient:" How Military Leadership Training and Experiences are Enacted in Engineering Education. *International Journal of Engineering Education*, vol. 35, no. 2, pp. 446-457, 2019.

Based on in-depth qualitative interviews with student veterans in the United States pursuing Bachelor's degrees in engineering across four institutions, we present findings relating military leadership and its application to engineering education. Our findings address three themes: (1) how leadership skills are learned, (2) motivation to be a leader, and (3) translation into, and enactment of military leadership skills in, engineering education. The interviews show that leadership skills and experiences acquired in the military play an important role in the academic experiences and success of student veterans in engineering (SVEs). Findings can help inform strategies and programs to encourage more SVEs to translate their leadership skills to an academic setting in an asset-based framework. Providing leadership opportunities for SVEs in the classroom has the potential to increase their engagement in engineering, strengthen their pathways to professional engineering practice, and provide important role models of servant leadership for the other engineering undergraduates who work with them.

## *First-Generation Student Veterans*

Based on our interview data, a paper exploring first-generation student veterans in engineering (FGSVE) was presented at the inaugural *Collaborative Network for Engineering and Computing Diversity (CoNECD) Conference* [21]. We continued this analysis adopting 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 article appeared in the first issue of 2019 in the *International Journal of Engineering Education* [9].

### *Findings on First-Generation Student Veterans*

From: C. Mobley, J. B. Main, C. E. Brawner, S. M. Lord, and M. M. Camacho, “Pride and Promise: Identity Salience and Enactment of First-Generation Student Veterans in Engineering,” *International Journal of Engineering Education*, vol. 35, no. 1A, pp. 35-49, 2019.

Our multi-method qualitative study examined how educational experiences of first-generation student veterans in engineering (FGSVE) in the United States are shaped by their first-generation, engineering, and military identities. Our study explores the extent to which FGSVEs’ first-generation identities are central to the FGSVEs, as compared to their military and engineering identities. We also investigate how these identities are related to one another and whether they influence the FGSVEs’ engineering education experiences.

Our qualitative data were derived from 15 in-depth interviews of FGSVEs conducted at four institutions in Fall 2016 and Spring 2017. Our case studies of four of these FGSVEs reflect several themes pertaining to identity salience, including: “The military was a bridge beyond first-generation status and into engineering;” “The military provided access to higher education and an engineering career will provide financial security;” “There is a dissonance between my first-generation, engineering, and military identities;” and “The military was both a detour and a necessary pathway into engineering education.”

The results reveal that the FGSVEs’ engineering and military identities were more central to their current experiences in engineering education than their first-generation status. All of these identities, however, were a source of pride in that the FGSVEs felt a sense of accomplishment for serving in the military, pursuing a college degree, and succeeding in a challenging major like engineering. For these students, both their military service and engineering pursuits offered promise for upward mobility. The results have implications for the design and implementation of programs for first-generation students in engineering and for student veterans in general.

### ***Black Student Veterans***

Based on our interview data, we are examining the experiences of Black student veterans in engineering (BSVE). A paper on this topic was presented at the 2019 *CoNECD Conference* [23]. We are continuing this analysis in more depth for a journal publication where a manuscript is in preparation. We are targeting journals such as the *Journal of Women and Minorities in Science and Engineering* (JWMSE) or *IJEE*.

### ***Findings on Black Student Veterans***

From: C. Brawner, C. Mobley, J. B. Main, M. M. Camacho, and S. M. Lord, “The Enactment of Race and Veteran Identities Among Black Male Student Veterans in Engineering,” *Collaborative Network for Engineering and Computing Diversity (CoNECD) Conference*, Washington, DC, April 2019.

Using interviews with seven Black Student Veterans in Engineering (BSVEs) at three predominantly White institutions (PWIs), we explore how the identities of Black, male, veteran, and engineering student are enacted during their undergraduate engineering experience. We approach this study informed by multiple dimensions of identity using an intersectional lens to answer three research questions: 1) Why did BSVEs join the military? 2) Why did BSVEs choose engineering? and 3) How do BSVEs enact their veteran, engineering, and racial identities while in school? We find that family influences, a desire to be part of something bigger than themselves, and economics were factors in BSVEs’ decision to join the military. Technical jobs in the military that often included exposure to engineers and engineering problems led them to the belief that as engineers, they would be able to solve many of the problems they faced while maintaining military hardware. All seven BSVEs claimed that their military and engineering identities were central, or nearly so, to their core identity. Of the five who mentioned racial identity, all indicated that it was central to their core being, often intersecting with their male identity.

### ***Gay Student Veterans***

Based on our interview data, we have begun to explore the experiences of gay student veterans in engineering and delivered a presentation about this at the 2019 *Collaborative Network for Engineering and Computing Diversity Conference* [24].

### ***Findings on Gay Student Veterans***

From: M. M. Camacho, S. M. Lord, C. Mobley, J. B. Main, and C. Brawner, “Exploring Narratives of LGBTQ Student Veterans in Engineering,” *Collaborative Network for Engineering and Computing Diversity (CoNECD) Conference*, Washington, DC, April 2019.

Despite important contributions to the literature on intersectionality, and a few excellent exceptions on LGBT experiences in engineering education, there continues to be a dearth of research on military student veterans who identify as LGBTQ. This research presentation brings an exploratory research focus to this subject. An inductive approach was applied to a broad study of student veteran experiences in engineering education at four universities in the U.S. The theme of sexuality was not central to the research design, but rather emerged authentically from a few of the respondents. Drawing on the sociology of transgender studies as a conceptual framework, this preliminary work explores the experiences of a few cisgender men in undergraduate engineering programs who are military veterans and identify as gay, using in depth, semi-structured interviews as the source of data.

This research makes an important preliminary contribution to the research frameworks of sexuality studies. In the past, themes of “deviance” and the “underworld” of sexual lives characterized social science studies of sexuality in the 1950s and early 1960s, casting a pejorative moral perspective on gay life. Foci began to change among social science researchers in the 1970s and 80s as researchers shifted analysis away from the individual-level of analysis toward communities, social life, and social movements among LGBT groups. In the 1980s and 90s, social constructionist frameworks offered a wider lens to gender and sexuality studies, and queer theory emerged as a challenge to heteronormativity, contributing to studies of intersectional identities. It is within this latter paradigm that our study is framed.

In this research presentation, we draw from research on transgender studies to highlight two perspectives that offer explanatory dimension to our respondents’ narratives: 1) perceptions of their *Identities and Social Locations* and 2) the *Institutional and Organizational Contexts* within which they make meaning.

### ***Institutional Agents Serving Student Veterans***

We analyzed our key informant interviews exploring their roles as campus allies and advocates. Results from this work will be presented at the 2019 *ASEE Annual Conference* [26].

#### *Findings on Institutional Agents*

From: C. Mobley, J B. Main, S. M. Lord, C. Brawner, and M. M. Camacho, “Institutional Agents’ Roles in Serving Student Veterans and Implications for Student Veterans in Engineering,” *2019 American Society for Engineering Education Annual Conference Proceedings*, Tampa, FL, June 2019.

As the number of student service members and veterans increases, universities are creating new programs or expanding existing programs to better serve the needs of this student population. In many cases, faculty and staff have become actively involved in advocating for student veterans and serving as allies for their success.

Our qualitative study on student veterans in engineering (SVEs) included in-depth interviews of institutional agents (IAs) at our four study institutions. We interviewed 24 individuals in Fall 2014 and Spring 2015. Interviewees worked in a variety of settings across campus, including financial aid and health services. We also interviewed a First-Year Engineering (FYE) staff member.

To better understand the broader context of SVEs’ educational experiences beyond departments of engineering, we explore the IAs’ perspectives on their duties in serving student veterans and their suggestions for improving policies and programs, both at the university level and within engineering. We also examine some implications of these perspectives for engineering education. We focus this study on two research questions:

1. How do IAs describe their roles and responsibilities as they pertain to student veterans in general?
2. What are IAs’ experiences in working with student veterans in engineering?

Our study highlights how IAs affect positive change for student veterans and help SVEs navigate the transition from the military to university structures and cultures. The IAs felt they played an instrumental role in expanding services for student veterans and in establishing a positive and supportive culture for student veterans. However, they also recognized the need for additional resources for and improvement in certain policies and programs. The results can inform university and departmental efforts to enhance SVEs’ transitions from the military to higher education and engineering studies.

### ***Student Veterans' Decisions to Major in Engineering are Influenced by Branch of Service***

During our analysis, differences among Navy and Marine Corps veterans emerged, particularly related to their choosing to major in engineering. A paper on this topic will be presented at the 2019 ASEE Annual Conference [25].

### ***Findings on Impact of Needs of the Force on SVEs Choosing to Major in Engineering***

From: C. E. Brawner, S. M. Lord, C. Mobley, J. B. Main, and M. M. Camacho, "How the Needs of the Force Impact Student Veterans' Decision to Major in Engineering," 2019 American Society for Engineering Education Annual Conference Proceedings, Tampa, FL, June 2019.

The Navy and Marine Corps are both branches of the US Department of the Navy. However, they have different missions in support of national defense and thus Sailors and Marines have very different job responsibilities during their service. This study investigates how these different roles impact their future choice to major in engineering. We explore three research questions. 1) What reasons did student veterans in engineering give for first enlisting in the Navy or Marine Corps? 2) What factors influence their job placement in the service? 3) How does military service influence their decision to later major in engineering? We find that patriotism and a desire to attain a sense of direction influences veterans to join both services but that Marine Corps veterans are more likely to report doing so out of a sense of pride and a desire to engage in combat than Navy veterans. Placement in military jobs is determined by the needs of the force and the capabilities of the Sailor or Marine. Those who score well on the Armed Services Vocational Aptitude Battery (ASVAB) have more choices and, in the Navy, are encouraged to join the nuclear program. Marines are more likely to be assigned where they are needed. Participants cited their technical training and a desire to improve processes and products as key reasons for pursuing engineering. Veterans in the nuclear Navy indicated that they were also encouraged through their training to seek higher education in engineering whereas Marine Corps veterans received no encouragement to seek higher education outside of the Marine Corps. Colleges of engineering can use this information to tailor their recruiting of former service members by connecting the dots from training to engineering education for those with technical training. For those without technical training, recruiting messages could emphasize the assets of discipline and hard work gained in the military as well as the opportunity to improve processes they may have encountered in their service.

## **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.

The annual in-person EAB meeting for Year 4 was held in San Diego, CA on June 1, 2018. Most members of the project team attended, either in person or through audio conferencing. Before this meeting, the research team prepared and distributed an annual report. In response to a request from the EAB in 2017, the research team also presented a PowerPoint overview of the project status and results. The EAB felt this helped them to quickly understand what the team had accomplished, to ask focused questions, and to understand the research team's next steps. Our process might be helpful for other research teams to consider particularly those teams working with advisory boards that include members from outside academia.

## **Mentoring**

The research team has provided research mentorship to one graduate student and two undergraduate students as part of this project. Mentoring students to conduct research in the field of student veteran engineers not only broadens the impacts of our work, but also provides valuable training to future scholars.

Rebecca Atkinson is a PhD student in Educational Leadership at Clemson University. Ms. Atkinson investigated the experiences of women veterans and was first author on a paper reporting these results that she presented at the 2018 ASEE Conference in the Military and Veterans Division.<sup>20</sup> This was her first research publication. This publication has provided the foundation for her dissertation on women veterans.

Hilal Kasim is an undergraduate student majoring in Computer Science and Agricultural Engineering at Purdue University. Ms. Kasim is an author on the paper investigating how veterans enact leadership in engineering education that will appear in *IJEE*.<sup>10</sup> This was her first research publication.

Joseph Murphy is an undergraduate student majoring in Sociology at Clemson University. Mr. Murphy is interested in investigating the experiences of engineering students who have served in the National Guard or Reserves. He has begun working on this research for an upcoming journal publication.

## **Acknowledgments**

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