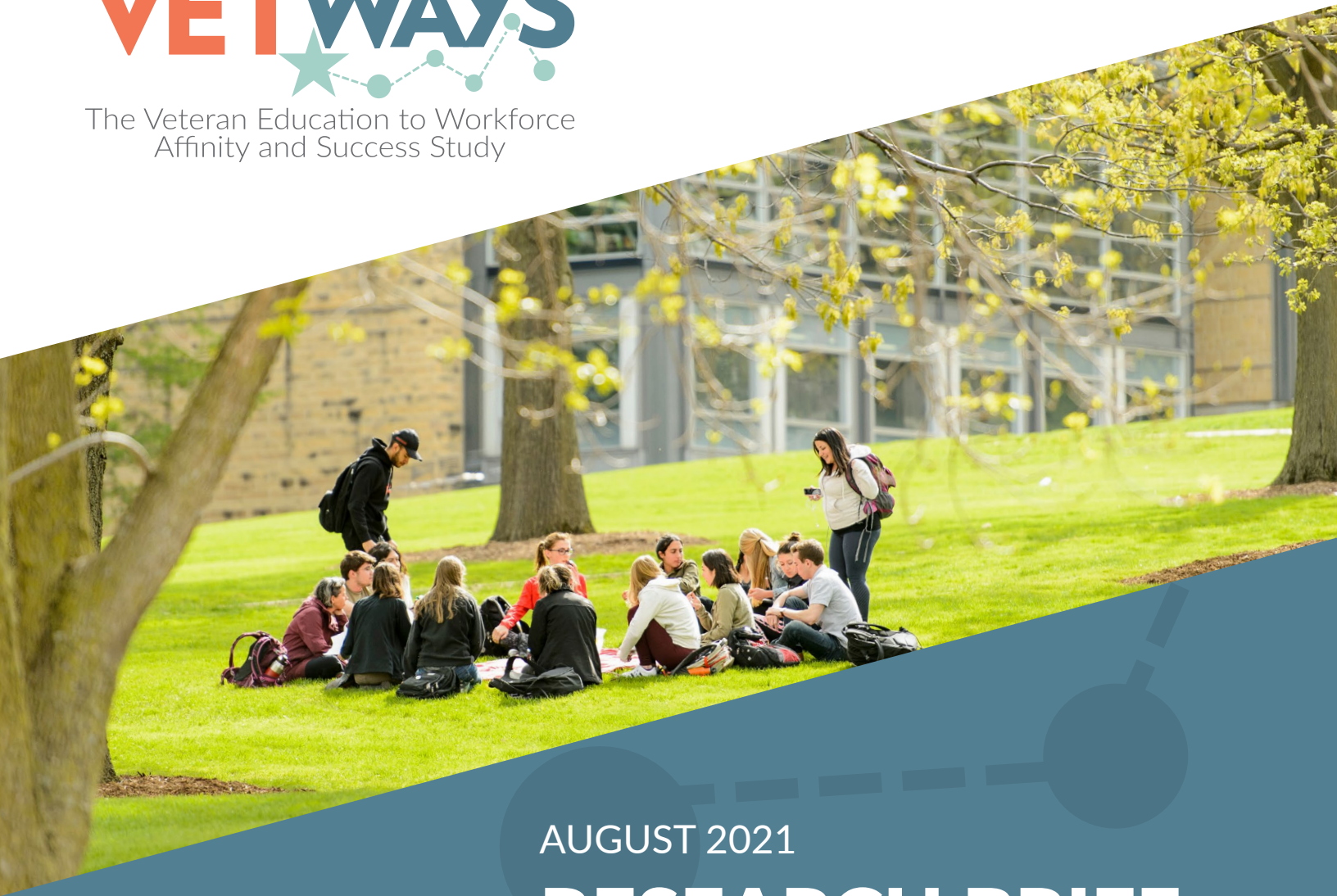




The Veteran Education to Workforce
Affinity and Success Study



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RESEARCH BRIEF

Describing Social Support
Networks Among Student
Military Service Members and
Veterans in STEM Majors

**Dr. Ross J. Benbow
and Ms. Xin Xie**

Wisconsin Center for Education Research
University of Wisconsin-Madison

SUMMARY

Equitable workforce development in science, technology, engineering, and mathematics (STEM) fields is increasingly important to national economic prosperity, health, and security. In recent years, student military service members and veterans (SSM/Vs)—a diverse undergraduate population with the technical training and capability to excel in STEM fields—are one of the fastest-growing groups of nontraditional students in American higher education. Recent figures, however, indicate that SSM/Vs graduate with STEM degrees at about half the rate of their traditional student peers. Considering the importance of *social support networks* for STEM majors and SSM/Vs, as demonstrated in past studies, as well as the lack of fundamental research focused on SSM/Vs in STEM, this study explores the characteristics and value of social support networks among SSM/Vs in university STEM majors using survey ($n=257$) and interview ($n=44$) data.

Key findings include:

- SSM/Vs that major in STEM fields list about five people on average with whom they discuss important personal and academic/career matters, including mostly friends and family.
- When measured on a scale from distant (1) to very close (4), STEM SSM/Vs reported an average tie strength with their social support contacts of 3.18, indicating “close” relationships.
- About one third of contacts within STEM SSM/Vs’ social support networks typically know one another. Interrelationships within social support networks make for tight-knit social circles, and can have positive or negative impacts on college students.
- Here, STEM SSM/V social ties are predominantly racially homophilous, meaning SSM/V support networks are mostly comprised of contacts with the same race/ethnicity as SSM/Vs.
- STEM SSM/Vs on average report less than one educator and less than one fellow student in their social support networks.
- Twenty-two percent of STEM SSM/Vs’ social support network contacts are service members/veterans.
- When asked to describe relationships that were valuable in college, STEM SSM/Vs spoke about contacts who offered them different perspectives and introduced them to different friendship circles, developing “bridges” that could provide novel information, opportunities, and social outlets.
- STEM SSM/Vs said the roles or positions of important network contacts were closely linked to the kind of support they offered; fellow college students and military veterans were reported to be particularly valuable for SSM/Vs.

Introduction and Background

Evidence suggests that science, technology, engineering, and mathematics (STEM) degrees and skills are essential to U.S. economic prosperity and security. Political and educational leaders have begun to focus on workforce development designed to boost graduation rates in university STEM programs, as many students who persist will eventually enter STEM professions (NSB, 2015, 2018; Pew, 2018). An important goal of these efforts is diversification of the STEM workforce to foster greater equity and innovation; yet underrepresented students continue to have higher attrition rates proportionally in college STEM programs than majority students (Handelsman et al., 2007; NSF, 2017).

Student service members and veterans (SSM/Vs) represent an undergraduate student population that could help overcome these challenges. First, SSM/Vs have constituted one of the fastest-growing groups of nontraditional students in American higher education over the last 15 years (e.g., Barry et al., 2014). Second, many SSM/Vs enter college with elite military training in sophisticated technical systems and equipment that positions them particularly well for STEM majors (NASEM, 2017). They also bring work ethic, teamwork, and leadership skills that are highly valued in STEM academic and employment fields (Benbow & Hora, 2018). Third, they are a diverse population. Compared with traditional students, SSM/Vs are older, more often underrepresented minorities, and more often first-generation college students from low-income backgrounds (e.g., American Council on Education, 2014).

Student service members and veterans are a diverse and capable group that can strengthen and diversify the STEM workforce. They graduate with 4-year STEM degrees, however, at much lower rates than traditional students.

These students' enrollment growth comes with challenges, however. SSM/Vs graduate with STEM-related degrees at much lower rates than traditional students (Cate et al., 2017; NSSE, 2010). SSM/V academic experiences in general can also be complicated by difficult military-to-civilian transitions, health challenges, and feelings of social and cultural alienation on campus (Ackerman et al., 2009; Livingston et al., 2011; Rumann & Hamrick, 2010; Semer & Harmening, 2015; Southwell et al., 2018).

Study Purpose

Successful college outcomes for SSM/Vs are achievable, and often linked in the research literature to *social support networks*, defined as groups of interpersonal relationships through which SSM/Vs exchange help, advice, and guidance (e.g., Griffin & Gilbert, 2015; Livingston et al., 2011). Little empirical research, however, has deeply explored what SSM/V social support networks actually look like—with whom they form, their characteristics, or what benefits they provide—even though enhanced social support is recognized as an important leverage point for improving the college success of under-supported students (Estrada et al., 2018; Steinberg & Diekman, 2017). Further, and especially in light of comparatively lower STEM graduation rates among SSM/Vs, little research has explored SSM/V experiences and perspectives in STEM majors, despite the opportunities this group represents for STEM workforce development.

With these gaps in mind, this mixed-method study uses social capital theory and social network analysis—a perspective that centers the explanatory power of an individual’s relationships or “social ties” (Wasserman & Faust, 1994)—to answer two research questions (RQs):

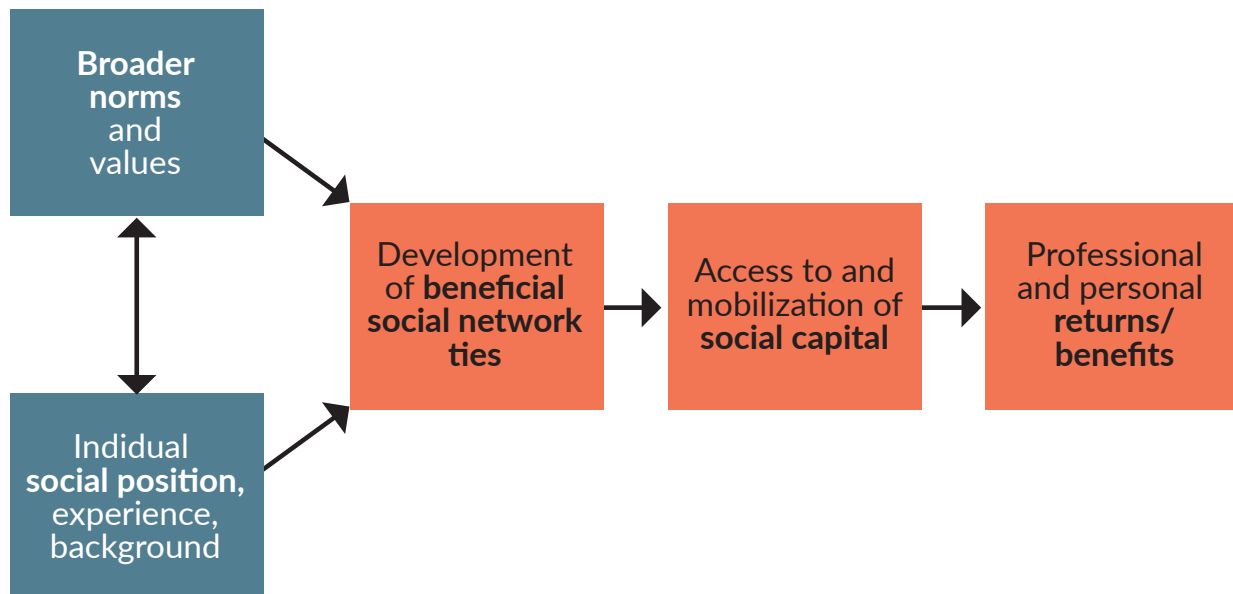
RQ1. What are the characteristics of social support networks among SSM/Vs in STEM majors?

RQ2. How do SSM/Vs in STEM majors describe their social support networks?

Social Capital

We frame this study using Lin’s (2001) theory of *social capital*, defined as actionable, valuable assets obtained through social ties. Lin’s (2001) approach, which is grounded in social network analysis, looks at social capital as resources that are embedded in social support networks that individuals access through social ties. According to Lin (2001), a person gains social capital (e.g., information, material items, camaraderie, emotional support) through a specific process. First, one’s social position and broader norms allow them to develop or not social ties and networks that are valuable. Second, these support networks provide them access to resources that can be “mobilized” through social interactions. Once social ties are accessed and mobilized, a person receives “returns” on their investment in the relationships. This process is displayed in Figure 1.

Figure 1. Modeling the support network development of social capital (based on Lin, 2001)



We operationalize this idea by measuring several valuable social support network features that have been shown in the research literature to benefit college students in general and SSM/Vs in particular (Borgatti & Halgin, 2011; Griffin & Gilbert, 2015).

Network size, referring to the number of contacts in one's social support network, is positively correlated with social support and college student achievement (Burt, 1987; Dawson, 2010). **Tie strength**,

representing how close individuals feel to their contacts, relates to dependability and the efficient exchange of information (Walker et al., 1994). **Density** represents the number of relationships among one's social ties and speaks to closer coordination and companionship (Burt, 1987). **Race homophily**, represented by the heterogeneity of one's contacts compared to oneself by race/ethnicity, associates with access to cultural awareness and a wider variety of novel information and perspectives (e.g., Perry et al., 2018). **Educator, college student, and military percentage**, representing the proportions of university faculty or staff, fellow college students, and service members or veterans in networks, respectively indicate access to mentorship and institutional support (Ackerman et al., 2009), deeper involvement in local academic communities (Kitchen et al., 2018), and feelings of camaraderie and connection with others with similar experiences (Barry et al., 2014).

This study uses the theory of "social capital," defined as actionable, valuable assets obtained through relationships, to explore important characteristics of SSM/V social support networks.

Research Methods

We answer RQ1 and RQ2 using a convergent mixed-methods case study (Creswell & Plano Clark, 2017), an approach in which a central issue is explored using quantitative and qualitative data. While our results answer these two questions, they are also meant to provide in-depth, multi-perspective descriptions of STEM SSM/V social support networks to help build basic research knowledge.

Sampling

We gathered data at five Wisconsin public universities (referred to as State Colleges 1–5) in the spring of 2020. These universities were chosen for their geographic and institutional diversity. We recruited respondents by asking veteran service coordinators in each of these universities to email study information and a link to a Qualtrics survey to all undergraduate SSM/Vs. These emails elicited 257 responses from SSM/Vs in National Science Foundation-designated STEM majors, including biological and life science, engineering, mathematics and computer science, physical science, and social science (see James & Singer, 2016). All survey respondents were also asked to volunteer for interviews, with 44 ultimately participating in 1-hour Zoom calls (Table 1).

Table 1. Descriptive statistics for STEM SSM/V survey (n=257) and interview (n=44) sample

Measure	Survey		Interview	
	N	%	N	%
Gender				
Female	60	23.3	9	20.0
Male	194	75.5	34	77.3
Nonbinary	3	1.2	1	2.3
Race/Ethnicity				
American Indian or Alaska Native	8	3.1	4	9.1
Asian or Asian American	21	8.2	0	0
Black or African American	9	3.5	3	6.8
Hispanic or Latino	17	6.6	1	2.3
Native Hawaiian of Pacific Islander	3	1.2	0	0
White or Caucasian	222	86.4	40	90.1
Undergraduate Major				
Biological and Life Sciences	46	17.9	8	18.2
Engineering	77	30.0	14	31.2
Math and Computer Science	47	18.3	16	36.4
Physical Science	13	5.1	6	13.6
Social Science	74	28.8	0	0
First Generation Students ¹	81	31.5	28	63.6
Institution				
State College 1	50	19.5	8	18.2
State College 2	67	26.1	14	31.2
State College 3	60	10.5	7	15.9
State College 4	27	17.0	4	9.1
State College 5	53	20.6	11	25.0
Mean Age	28.3 (SD=7.4)		28.4 (SD=7.5)	

¹ "First Generation" students are students reporting that their parental guardians have not obtained a 4-year college degree.

Analysis

Surveys. We answer RQ1 using data from online surveys. Surveys were designed to measure the seven social support network attributes described above, following established “egocentric” social network analysis techniques focused on gathering precise data on core social support networks surrounding STEM SSM/V respondents, or “egos” (e.g., Perry et al., 2018). Each respondent was asked

to list people they talked to about important matters (Burt, 1984) as well as academic/career issues (e.g., Benbow & Lee, 2021), contacts described as “alters” in social network analyses. They then were asked to answer several questions about the listed alters, including how close they felt to each alter (measuring *tie strength*), whether each alter knew the others (*density*), the race/ethnicity of each alter (*race homophily*), the perceived role of each alter (friend, family member, fellow student, college educator, etc.; measuring *educator ties and student ties*), and whether each alter was a service member or veteran (*military ties*).

Survey analysis entailed analyzing responses in *ENet* (Borgatti, 2006) to develop our egocentric network measures, from which we calculated the basic statistics reported below. To supplement results, we developed figures further exploring tie strength, race/ethnicity, and role (friend, family member, fellow student, etc.) dimensions. We also created a “sociogram,” a map of an example social support network, to illustrate network density.

Interviews. We answer RQ2 using semi-structured interviews of SSM/Vs in STEM. We designed interview questions to elicit student perspectives on their social support networks by asking about survey-reported alters who offered support students thought was particularly helpful in college. Interviews were audio recorded and transcribed for analysis.

To analyze the interviews, each author randomly selected segments from 10 STEM SSM/V transcripts and open coded the data, developing nodes based on reported social support ideas and experiences. Next, we grouped nodes by similarity into larger code groups and reread transcripts to further add to and refine groupings (Saldaña, 2015). After comparing our interpretations, we reconciled code lists and applied the final codebook to all transcripts. A final analytical process based on the research questions, interviewee repetition, and our theoretical framework (Ryan & Bernard, 2003) resulted in a table of six themes (Table 3). Below, we describe two of these themes in detail.

We answer our research questions using online survey and interview responses from SSM/Vs in STEM majors across five Wisconsin public universities.

Results

RQ1. What are the Characteristics of Social Support Networks Among SSM/Vs in STEM Majors?

The survey generated network data for 242 STEM SSM/V social support networks, including 1,354 listed network alters. Descriptive statistics for the focal network measures among STEM SSM/V networks are listed in Table 2.

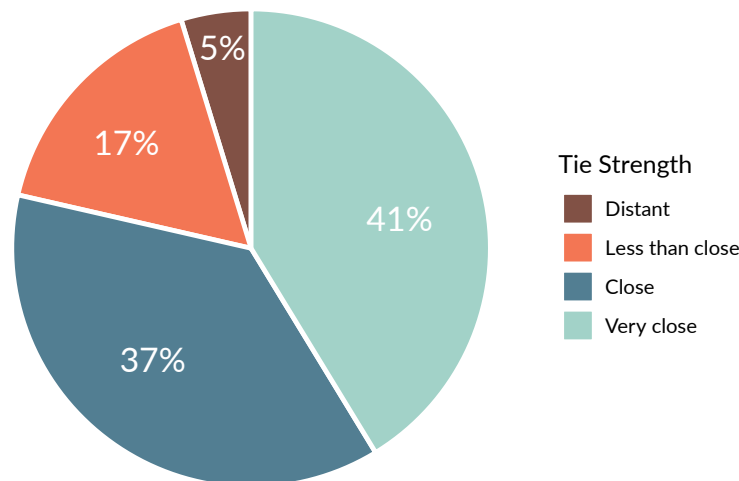
Table 2. STEM SSM/V social capital-oriented network measures

Network measures	Mean	SD
Network size	5.27	2.80
Tie strength	3.18	0.52
Density	0.33	0.28
Race homophily	-0.60	0.61
Educator percentage	0.07	0.18
Fellow student percentage	0.07	0.15
Military percentage	0.22	0.25

With regard to network size, SSM/Vs listed about five alters on average with whom they discussed important personal and academic/career matters. Further, STEM SSM/Vs reported an average tie strength of 3.18, indicating “close” relationships with alters. Figure 2, which shows the distribution of tie strength proportionally, illustrates that STEM SSM/Vs considered almost 78% of listed alters “close” or “very close.” The literature shows that “close” relationships allow individuals to receive every day and emergency support (Wellman & Frank, 2017), though they may not be as close as relationships SSM/Vs have in the military (e.g., Williston & Roemer, 2017).

SSM/Vs that major in STEM fields list about five people on average with whom they discuss important personal and academic/career matters, including mostly friends and family.

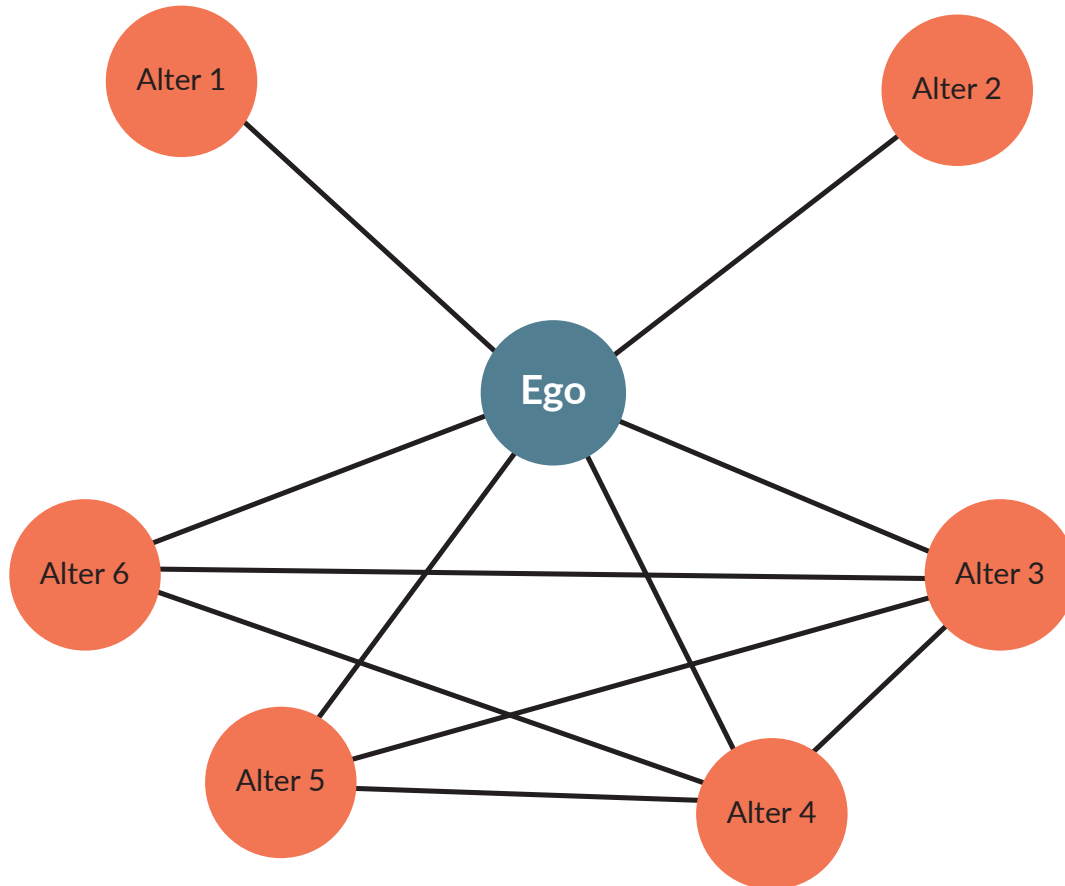
Figure 2. Tie strength of STEM SSM/V social support network alter connections



Average network density among STEM SSM/Vs, which has been found to have a positive impact on college students’ academic performance (Eckles & Stradley, 2012), is 0.33. Thus, about one third of alters are

connected to one another across SSM/V networks. Figure 3 illustrates this concept with a diagram showing a social support network with a 0.33 density score. The listed relationships between the ego and her alters, as well as among the alters, are represented as lines between the nodes.

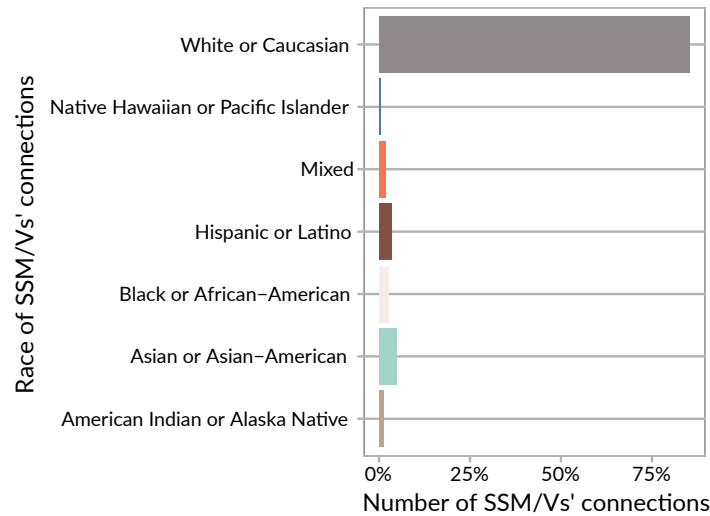
Figure 3. Example 0.33 density for STEM SSM/V social support network



We measure race homophily—which can cultivate greater cultural awareness and provide new information and understanding (Antonio, 2001)—using a score called the External-Internal Index (Krackhardt & Stern, 1988). This score measures the average similarity between the SSM/V respondent’s race/ethnicity and the race/ethnicity of listed alters, with -1.0 representing complete homophily (the network is comprised of alters who are similar to the ego) and +1.0 representing complete heterophily (the network is comprised of alters who are dissimilar to the ego).

Here, SSM/V race homophily averages out to be -0.60, indicating that these SSM/V support networks tend to include more alters from within egos’ race/ethnicity groups than from outside. Indeed, while Figure 4 shows that over 75% of reported alters are White, 86% of the STEM SSM/V sample identified as White. The tendency to connect with people of the same racial and ethnic background is expected (see McPherson et al., 2001), particularly in the predominantly White Wisconsin communities and STEM classrooms in which these SSM/Vs live and learn.

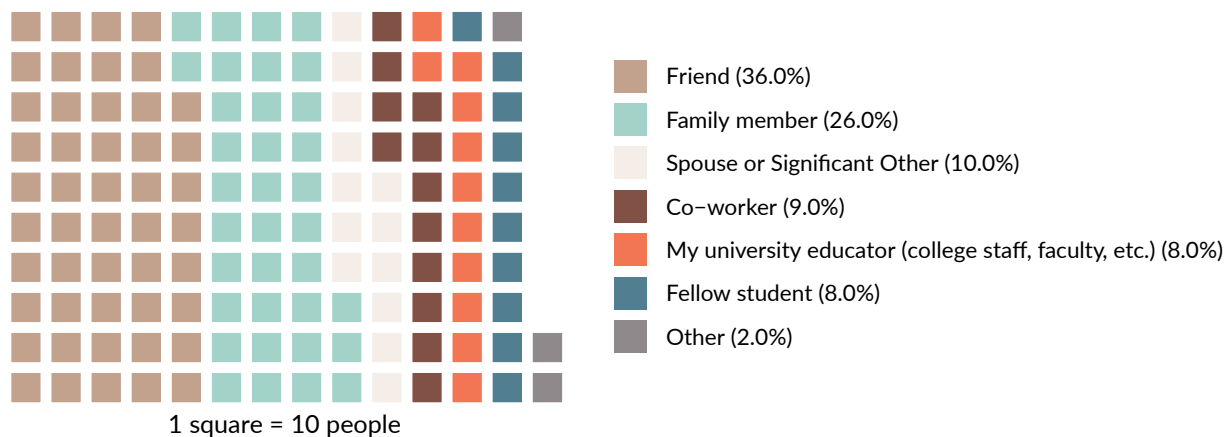
Figure 4. Race/ethnicity of STEM SSM/V social support network alters



Alter roles are also important sources of network social capital (Lin, 2001). STEM SSM/Vs on average report less than one educator and less than one student in their social support networks. Figure 5, which reports role proportions among all listed alters, shows that friends, family members, and spouses/significant others combined constitute about 72% of network alters, with educators and students comprising only 16%.

STEM SSM/Vs on average report less than one educator and less than one fellow student in their social support networks. Military social ties are more robust, with 22% of STEM SSM/V network contacts being service members/veterans.

Figure 5. Distribution of STEM SSM/V social support network alter roles



While the lack of educational connections could pose challenges for SSM/Vs to engage with local academic communities (Kitchen et al., 2018), network military percentages, shown to ease SSM/V academic trajectories and increase a general sense of belongingness (Brewster et al., 2020), are more robust. On average, 22% of STEM SSM/V social support network alters are service members/veterans.

RQ2. How Do SSM/Vs in STEM Majors Describe Their Social Support Networks?

Table 3 displays the six themes that emerged from interview analysis. Because of space considerations, here we describe in detail two themes that connect closely to our survey results: “bridging perspectives” and “role-based support.”

Table 3. STEM SSM/V social capital-oriented support network resources and benefits

Theme ²	Definition	Example Quotation
Bridging perspectives	Help, advice, feedback, or “an ear” that motivates, helps STEM SSM/Vs see new/different perspectives, and/or encourages STEM SSM/Vs to make new connections	“I’ve met her friends that have a similar positive focus on academics, that understand that getting good grades is important...my friends generally aren’t like that...but she’s introduced me to a lot of people that share that with me.” - <i>State College 2, Male</i>
Emotional support	Affective, caring, and/or unconditionally supportive relationships, often based on mutual understanding where SSM/Vs in STEM can be as they are	“It’s good to have someone that knows you and you can engage with comfortably. You don’t have to be putting up a face or be on edge or anything with her. It can just be open and candid so that’s definitely valuable.” - <i>State College 4, Male</i>
Hands-on academic/career support	Practical assistance with tasks such as mock interviewing, applying for college, developing pro/con lists, teaching, or composing a CV	“Sometimes when I’m writing stuff for my classes it’s good to have her read it over, and she’ll be like, ‘Oh, this is wrong English,’ and I’m like, ‘Oh, sorry,’ and I correct it.” - <i>State College 1, Male</i>
Health and well-being support	Opportunities or encouragement forget worries and focus on physical or mental health, particularly through leisure time, humor, exercise, getting outdoors, etc.	“It’s important to maintain physical and mental health. Being able to tell him about how my workouts are going, or being able to work out with him in general, is nice. We have that connection.” - <i>State College 2, Male</i>
Role-based support	Alter employment, educational, and/or experiential positions that give STEM SSM/Vs access to important informational, instructional, or affective resources	“He’s just there mentally, emotionally if I feel like I’m having a hard time. He actually works for the VA, so he has some experience working with veterans. He is a great resource to have.” - <i>State College 3, Male</i>
Safety and security	Support that lessens or alleviates burdens like paying the rent/mortgage, taking care of children, cooking/cleaning, and other responsibilities	“I didn’t have any place else to go. It’s like I came back to the property from the military, we stored my stuff there until I could get my own house, we talk regularly, she started giving my sister hell for giving me a hard time.” - <i>State College 3, Female</i>

² Themes are presented in alphabetical order.

Bridging Perspectives. When asked to describe relationships that were valuable in college, many STEM SSM/Vs spoke about alters who were able to offer them different perspectives. Many students reported that honest, straightforward advice or guidance was especially helpful. One male SSM/V in STEM at State College 1, for instance, described a friend's relationship advice. "She just gave me nonjudgmental advice. Like, 'Hey, this is how it typically goes. This is probably why she did this.'" It was valuable not only for its clarity, he added. "If I asked one of my Marine buddies, they'd say, 'Just dump her.'" Further, even if interviewees disagreed with their alters' advice, many recognized the benefit in expanding their outlook. "I may still disagree with my wife," one male State College 4 student told us, "but she makes sure I think about things in a different way."

Many STEM SSM/Vs spoke about social ties who were able to offer them different perspectives as well as introduce them to different friendship circles, developing "bridges" to novel information, opportunities, and social outlets.

Alters also introduced SSM/Vs to different friendship circles, thereby developing "bridges" for STEM SSM/Vs that could provide novel information, opportunities, and outlets (Lin, 2001). A State College 2 student explained, for example, that one friend was especially important because she opened up a part of college life to which he thought he would not have access. "She still treats me like a peer," he said. "I find that reassuring because it feels like I can make friends with people that are younger than me, and that my experience isn't any different. I actually look to her to get away from the veteran experience." Having access to diverse perspectives is a special concern for network theorists, who argue that socially novel viewpoints—that can come through larger or more diverse networks, for instance—allow access to more valuable and innovative resources (Burt, 1987; Lin, 2001).

Role-Based Support. Interviewees indicated that the roles or positions of the network alters important to them were closely linked to the kind of support the alters offered. While SSM/Vs in STEM mentioned the value of people in several other roles, they focused particularly on alters who were college students and military veterans. Typically, STEM SSM/Vs talked about the support of fellow students in their university who were going through similar programs. One State College 3 student, for example, spoke of someone who was a year ahead of her. "We're both in engineering, so we're both going through the struggle," she said. The shared experience not only helped them relate, but also allowed them to assist one another. In other instances, different kinds of student roles were helpful. In one case, another STEM SSM/V at State College 3 described how important it was that a student friend *was not* in her major program. Her major was extremely competitive. "School isn't really a competition with her" she said, "so it balances the stressors." In other cases, SSM/Vs in STEM spoke about the value of social ties with former university students.

STEM SSM/Vs said the roles of important network contacts were closely linked to the kind of support they offered. Fellow college students and military veterans were reported to be particularly valuable for SSM/Vs.

Following previous research (e.g., Griffin & Gilbert, 2015) interviewees also spoke about the value of military friends who understood their experiences. “I don’t see relationships like this in the civilian world,” a State College 3 male told us about one veteran in his social support network. “It’s an easier experience for me to be linked up with someone who knows the walk of life that I came from.” The relatedness, interviewees reported, not only brought back feelings of military camaraderie, but also created space for talking about, and counseling one another through, more difficult service-related issues. “We need to have someone that we can go talk to about that kind of stuff,” a State College 2 student said, referring to discussions he sometimes had with a longtime military friend. “He and I both have the same things that we deal with regarding our service, so it’s always been pretty crucial.”

Conclusions and Implications

It is important to focus on STEM SSM/V support networks and the kinds of ties that can assist service-oriented, working class, and often first-generation students as they make their way through elite university majors into elite professions. To our knowledge, no prior research has looked in detail at social support among SSM/Vs in STEM majors. Our findings suggest ways university educators can better support these students, whether through initiatives that pair STEM SSM/Vs with other campus affinity groups; Green Zone training—which provides campus staff and students with information on military students’ backgrounds and experiences—to create more supportive faculty and peer environments; or other community-building programming to connect SSM/Vs with traditional students and on-campus experiences. Future research should build from these descriptive findings to study how specific social support network characteristics associate with beneficial personal, academic, career satisfaction among SSM/Vs, in STEM and across all majors.

Results suggest opportunities to assist STEM SSM/Vs in further developing beneficial social support networks by, for instance, linking SSM/Vs to other campus affinity groups, community-building among SSM/Vs, and helping SSM/Vs connect with more traditional students, staff, and faculty members on campus.

A widening civilian–military divide, in which one class of Americans bears an impossible burden for the others, has rendered military service members, veterans, and their families less visible with each passing year (e.g., Phillips & Arango, 2020). Social alienation and incongruities within STEM majors further exacerbate difficulties, weakening STEM workforce diversity and innovation in the process (Page, 2008). We call for educational research that begins to counteract this inequity.

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The Veteran Education to Workforce
Affinity and Success Study

About

The Veteran Education to Workforce Affinity and Success Study (VETWAYS) is a three-year National Science Foundation-funded project focused on the social support networks and career pathways of a growing and increasingly important segment of the U.S. college student population: military service members and veterans.

Contact Us

Dr. Ross Benbow, Principal Investigator
University of Wisconsin-Madison
Wisconsin Center for Education Research
551J Educational Sciences Building
1025 W. Johnson Street
Madison, WI 53706
vetways@wcer.wisc.edu
vetways.wceruw.org



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