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Exploring Student Service Member/Veteran Social Support and Campus Belonging in University STEM Fields

Ross J. Benbow You-Geon Lee

Supported by considerable public investment through post-9/11 higher education benefits, student military service members/veterans (SSM/Vs) have been one of the fastest-growing groups of nontraditional students in American universities in recent years. Despite their increased numbers and potential to diversify science, technology, engineering, mathematics, and medical (STEMM) fields, little research has explored SSM/V academic development and success across university STEM contexts. This mixed methods study used social capital theory to explore links between STEM SSM/V social support and a sense of campus belonging—shown to be important to achievement among traditionally marginalized college students—within 4-year campus communities. Social network analyses of surveys indicated that larger SSM/V support networks, including on- and off-campus social ties as well as student and university educator ties, positively correlated with campus belonging. Social support networks with military ties, traditionally seen to benefit SSM/V college integration, did not correlate. Interview responses suggested that while belonging can be discouraged among SSM/Vs by military-associated STEM imposter feelings, it is fostered through student friendship, faculty care, and veteran-focused campus support. Results underscored the importance of authentic interaction as well as purposeful efforts to bring SSM/Vs together with fellow students, educators, and staff.

With evidence suggesting that science, technology, engineering, mathematics, and medical (STEMM) workforce development is important to US economic interests, increasing student persistence in university STEM majors has long been a national priority (NSB, 2018). Of particular concern are efforts to boost STEM career opportunities among traditionally marginalized college populations—including women, African American, Latina/o, and Indigenous students, first-generation students, disabled students, and students from low-income backgrounds. Despite years of national effort to diversify the STEM workforce, however, individuals from these groups continue to be underrepresented (Jelks & Crain, 2020; NSF, 2017). Student military service members/veterans (SSM/Vs) or undergraduates on active duty, in the National Guard or reserves, or who have completed military service (Barry et al., 2014) are a highly skilled population that offers promise in this regard (e.g., Werum et al., 2020). Supported by substantial governmental and institutional spending (USVA, 2016) and often with multiple intersecting identities that could diversify the workforce, SSM/V success is vital to public interests. Few studies, however, focus on SSM/V social development in STEM majors.

While SSM/V experiences in STEM settings are underexplored, previous work has offered a way forward. It is well established that social and academic climates and a student's

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sense of campus belonging—or their cognitive evaluation of membership and connection within their campus community (Hurtado & Carter, 1997)—are important to college success in general and STEMM completion in particular, especially for marginalized students (e.g., Museus et al., 2017; Rainey et al., 2018). Studies have also suggested that SSM/V academic outcomes improve with strong social support, akin to the camaraderie experienced in the military (e.g., Livingston et al., 2011). But few studies have offered an in-depth exploration of relationships among SSM/Vs or investigated how they could be a valuable leverage point for student affairs personnel, faculty, and other educators seeking to improve SSM/V experiences. We contend that a better understanding of the connections between campus belonging and STEMM SSM/V social support could accomplish three important goals. First, it could provide university educators research-based evidence to guide SSM/V “network intentionality” (Moolenaar, 2012)—a practice associated with purposeful network building among teachers that could, with more data, be applied to students. Second, it could inform local inclusivity efforts seeking to better support students, like SSM/Vs, with intersecting marginalized backgrounds. Third, it could help scholars begin to build a knowledge base focused on SSM/Vs in STEMM, which has been underdeveloped.

With these needs in mind, this study used a mixed methods, egocentric network analysis of student survey ($n = 333$) and interview ($n = 54$) data to investigate links between belonging and social support among SSM/Vs in STEMM majors. We framed our analysis using Lin’s (2001) theory of social capital, which allowed us not only to precisely model a process by which investment in, access to, and mobilization of social support lead to social “returns” but also to explore how measurable SSM/V relational assets associate with belonging. Using this framework, we answer two research questions (RQs):

RQ1. How, if at all, does social support associate with a sense of campus belonging among SSM/Vs in STEMM majors?

RQ2. What social support factors, if any, do SSM/Vs in STEMM majors believe influence their sense of campus belonging?

This study sought to expand literature centered on diversifying educational opportunities in STEMM fields, belonging among marginalized university students, SSM/V campus experiences, and college student social support. We begin our literature review by focusing on diversity and social barriers in university STEMM fields and then discuss campus belonging, persistence, and social support among marginalized students. We conclude by focusing on SSM/Vs and on- and off-campus social support networks.

LITERATURE REVIEW

STEMM University Diversity and Social Barriers

National scientific and medical workforce needs are only increasing with rapid technological change and global public health challenges. Despite years of reform efforts, however, women, first-generation students, those from low-income backgrounds, students with disabilities, and African American, Latina/o, and Indigenous students remain underrepresented across many STEMM academic programs and careers (e.g., Jelks & Crain, 2020; NSF, 2017).

What facilitates this inequity? The answer lies, in part, in students’ social experience, a factor that is especially significant in scientific education, where disinclination is often fostered by continual challenges to student inclusion (e.g., McGee, 2016; Xie et al., 2015). While differences in high school preparation or interest explain some variation in STEMM major selection, peer and faculty stereotypes and incongruities between the sociocultural attributes of

these fields and the preferences of marginalized students do, as well. Among women, research has shown that underrepresentation, a lack of peer interaction, and negative environmental cues can lead to a loss of interest in STEMM (e.g., Lewis et al., 2016; Rainey et al., 2018). African American, Latina/o, and Indigenous students face multiple systemic forms of bias that socially exclude them from STEMM fields. These include the fear of confirming negative racial stereotypes, an underrepresentation of Faculty of Color, prejudice and skepticism from peers and instructors, and “battle fatigue” or the stressors that come with continually operating in discriminatory, predominantly White environments (e.g., McGee, 2016). Though African American, Latina/o, and Indigenous students face particularly insidious and persistent challenges in this regard, research has shown that first-generation and low-income students also experience negative explicit and implicit social cues in STEMM environments that foster anxiety, a lack of confidence, and the feeling that they are intellectual “imposters” (Canning et al., 2020; Chrousos & Mentis, 2020; Daehn & Croxson, 2021). Importantly, while scholars contend that students with military backgrounds experience somewhat similar incongruities (e.g., McAndrew et al., 2019), little work has focused on this phenomenon among SSM/Vs in university STEMM fields.

Campus Belonging, Persistence, and Social Support Among Marginalized Students

Students’ sense of belonging—or their sense of affiliation, identification, and membership in the campus community (Hurtado & Carter, 1997)—relates closely to these ideas. Conceived as a cognitive evaluation of one’s social environment that motivates attitudes and behavior, *belonging* comes from the sense that one is valued and matters to others. This sense, in turn, provides individuals with purpose,

meaning, and connectedness associated with any number of beneficial outcomes, from mental health and fitness to happiness (Baumeister & Leary, 1995).

To Strayhorn (2018), belonging is a central need that must be met before an individual can move on to the higher-order intellectual achievements associated with college success. Students, he writes, are continually working in different sociocultural spheres, or “multiple circles,” as they “negotiate” college (p. 43). While Strayhorn (2018) characterized this need as fundamental, he argued that it could be even more important for students who, because of marginalized identities or experiences, are often excluded from campus spaces, a finding well supported in the literature (e.g., Lewis et al., 2016; Rainey et al., 2018). This concept has played a significant role in the study of college student perception and persistence. Here, research has shown that students who feel like they belong on campus—and who feel their institution is fulfilling promises made during the recruitment and admissions process (referred to as “institutional integrity”; Braxton et al., 2011)—are more likely to thrive in college, whether through interpersonal connections, investing effort in meeting educational goals, or using student services (Museus et al., 2017).

Students’ social experiences, which play such an important role in STEMM persistence, are tightly intertwined with belonging. While scholars have explored this connection in various ways, *social network analysis*, a research perspective focused on how outcomes link to relationships, offers one particularly robust and conceptually nuanced approach (Smith & Vonhoff, 2019). Indeed, while affirmational classroom- or discipline-based interpersonal relationships have been shown to ease marginalized student burdens—and lead to interactions that buttress socio-academic integration (Deil-Amen, 2011)—network studies have also

shown that students often develop such relationships based on shared identities (McCabe, 2016). This tendency effectively sidelines marginalized students who are outnumbered in most STEMM fields (Brown, 2019). Again, few studies to date have explored this dynamic among STEMM SSM/Vs, a diverse and emerging population whose success is so important.

Student Service Members/ Veterans and On- and Off-Campus Social Support Networks

State and federal post-9/11 GI education benefits provide funding for tuition, housing, and supplies to military-affiliated college enrollees and have spurred exponential growth in the SSM/V population, increasing their numbers from about 500,000 in 2009 to nearly 900,000 in 2019 (USVA, 2020). This represents a substantial public investment in SSM/V success, with the U.S. Department of Veterans Affairs spending billions annually on post-9/11 educational expenses in recent years (USVA, 2016).

It also represents a unique opportunity. Similar to the wave of World War II veterans who helped expand higher education in the 1940s and 1950s, data on SSM/Vs show a student group well-positioned to broaden and strengthen the US workforce. Yet, this veteran population is more diverse—and, some argue, more isolated from the civilian population (Zucchini & Cloud, 2015)—than that of earlier generations. Compared to traditional college students, data suggest contemporary SSM/Vs are older, more often African American, more often first-generation students from low-income backgrounds, and more likely to report physical and cognitive impairments (SVA, 2020). Many enter college with advanced teamwork and problem-solving skills, medical training, or experience working with sophisticated technological systems—attributes that prepare them particularly well for STEMM fields (Benbow & Hora, 2018; Werum et al., 2020).

But SSM/Vs also face an array of challenges common to nontraditional students that exacerbate STEMM barriers, including delayed enrollment, transfer status, commuter status, and full-time work responsibilities (Barry et al., 2014). Other challenges are more specific to SSM/Vs, underlining how military affiliation, in and of itself, can link to marginalization. Mental health struggles, a significant issue for those who have been deployed, have been the focus of much contemporary SSM/V research (e.g., Campbell & Riggs, 2015), as are difficulties with military-to-civilian cultural transitions (Griffin & Gilbert, 2015), sudden activations (Ackerman et al., 2009), and a disinclination to seek help (Borsari et al., 2017). Importantly, studies consistently point to SSM/V feelings of alienation and disjointedness on campus (e.g., Barry et al., 2021; McAndrew et al., 2019; Rumann & Hamrick, 2010), often resulting from troubled communication with peers and faculty who may have more liberal political beliefs, ask insensitive questions, or stereotype SSM/Vs as violent or damaged (e.g., Borsari et al., 2017; Livingston et al., 2011).

While little previous work has investigated university social and academic integration among STEMM SSM/Vs, network and relational research provides a promising avenue for further exploration. Studies have shown that social support, a significant factor in student college success, is particularly important among SSM/Vs (e.g., Barry et al., 2014; Livingston et al., 2011). On campus, relationships developed through professional organizations, veteran groups, and student services can help increase feelings of inclusivity and adaptation that portend well for persistence, help students balance academic and social lives, and provide meaningful support (Griffin & Gilbert, 2015; McCabe, 2016). Further, classroom faculty contacts and peer networks have been shown to boost student learning and create socio-academic integrative moments that help adult

students in particular, though researchers have not yet explored how SSM/V support networks follow these patterns (e.g., Brown, 2019; Deil-Amen, 2011). Significantly, though research has shown that SSM/Vs receive less social support from university peers than civilian students (Whiteman et al., 2013), because of their age and positionality, these students often have opportunities to benefit from broader, off-campus family and friend support (Bean & Metzner, 1985). Similar to research indicating the benefits of off-campus relationships for Latina/o undergraduates (Rios-Aguilar & Deil-Amen, 2012), studies have shown that SSM/V non-college relationships often help alleviate academic pressure (Romero et al., 2015). Still, to our knowledge, no work has explored direct links between social support networks on- and off-campus and feelings of campus belonging among SSM/Vs in STEMM fields.

CONCEPTUAL FRAMEWORK

We frame our understanding of these links using Lin's (2001) theory of *social capital*, defined as actionable, valuable assets like information, camaraderie, or emotional support that flow to and from individuals through relationships or "social ties." According to Lin, when one puts energy into building and maintaining social ties, they can be accessed and mobilized for a return on this "investment." Specifically, social capital is invested in and developed through phases. First, one's hierarchical place or "position" in broader social exchanges, like their occupation or identity, interacts with multi-layered, meso- to macro-level "structures" that impose values and hierarchies, like the norms of one's institution or community (Lin, 2001).¹ Second, this

interplay allows one to build relationships (or not), which provide "accessibility" to potential benefits. Third, individuals "mobilize" social ties through interpersonal interactions to accrue benefits or "returns" that give them a personal or professional advantage. Here, we explore the particular kinds of social support that increase student social capital returns in the form of a sense of campus belonging, a fundamental antecedent to academic success for students who may experience university STEMM environments as "different, unfamiliar, or foreign" (Strayhorn, 2018, p. 90). We display this process, contextualized for our study, in Figure 1.

Lin's (2001) theory is useful because it allows us to model a process connecting SSM/V social support to campus belonging that fits this investigation empirically and phenomenologically. Empirically, the model is based on a precise, theoretically grounded approach to measuring social support with social network analysis, a technique that, as Smith and Vonhoff (2019) write, "offers the ability to map the connections, resources, and both positive and negative outcomes of multilevel campus communities" (p. 260). Indeed, the "egocentric" social network approach we use here not only allows us to measure social ties across demarcated boundaries (e.g., whether on- or off-campus) but also evokes Strayhorn's (2018) concept of the multi-layered social "circles" within which campus belonging is fostered.

Importantly, while traditional social capital models often privilege relational resources possessed by dominant groups (e.g., occupational status), we quantitatively operationalize Lin's (2001) theory to center campus belonging and student-oriented social assets. In defining

¹ Here, we follow Lin's (2001) theoretical writing and use the terms *structure* and *position* to specify how interacting, meso- and macro-level preconditions afford and constrain social capital development. Among social network scholars, however, structure can refer to patterns of interrelationships within social networks, and position can refer to the location of a particular individual or node in relation to network resources.

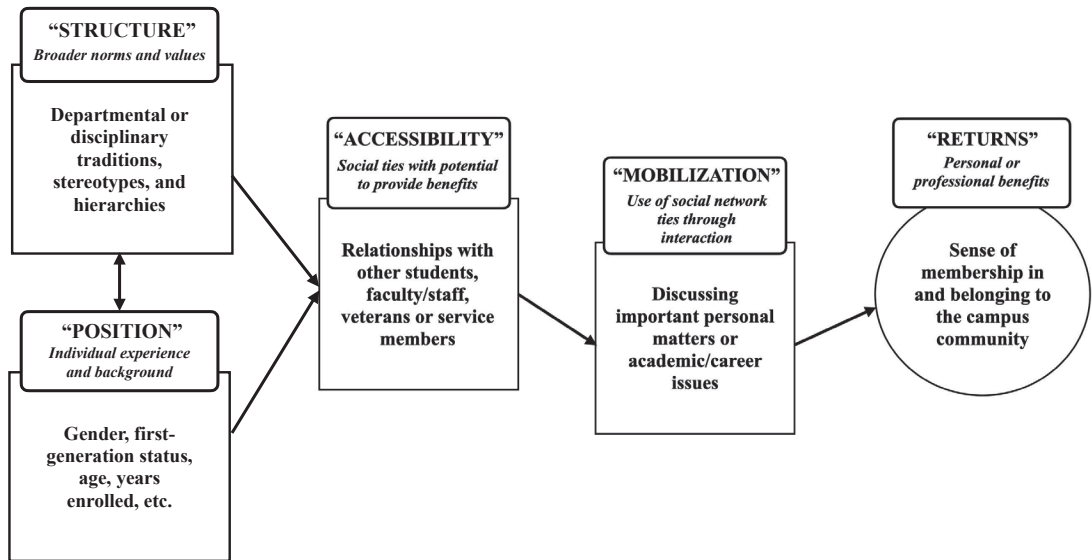


FIGURE 1. Developing Campus Belonging-Oriented Social Capital Among SSM/Vs (Lin, 2001)

our focal independent variables, then, we integrate one social capital measure supported by decades of research with three indicators shown to improve the experiences of marginalized college students and SSM/Vs in particular. Our traditional social capital measure, *network size*, refers to the number of alters in one's support network and has been shown to connect to student academic and social integration (Brown, 2019). *Educator ties*, defined as whether one talks to university faculty or staff, have been shown to allow students greater access to academic, institutional, and career support (Deil-Amen, 2011; Estrada et al., 2018). *Student ties*, defined as whether one talks to fellow college or university students, can draw students into academic and professional STEM communities (e.g., Thomas, 2000). *Military ties* measures a source of SSM/V-specific cultural strength, as relationships through which SSM/Vs can commiserate with others who have similar military experiences have been shown to be particularly important to college transitions for this population (Barry et al., 2014).

METHOD

This is a convergent mixed methods case study (Creswell, 2014), an approach in which a bounded issue is explored using quantitative and qualitative data. Data were collected simultaneously and then analyzed separately to answer our research questions and provide a triangulated interpretation of SSM/V social support and belonging.

Participants

Surveys and interviews were administered to SSM/Vs in five public universities in Wisconsin chosen for their varying size and geographic diversity. Participants included 333 self-identified SSM/Vs from these universities who completed surveys. A subset of 54 students participated in interviews. All SSM/Vs were majoring in STEM fields (NSB, 2018). Table 1 displays the attributes of the survey and interview samples.

We first recruited SSM/Vs in spring 2020 by asking veteran service coordinators in each

Table 1.
Descriptive Statistics for SSM/V Survey Instrument ($N = 333$)
and Interview Participants ($n = 54$)

Measure	Survey		Interview	
	<i>n</i>	%	<i>n</i>	%
Sex				
Female	96	28.9	17	31.5
Male	232	69.9	36	66.7
Nonbinary	4	1.2	1	1.9
Race/ethnicity				
American Indian or Alaska Native	8	2.4	4	7.4
Asian or Asian American	25	7.5	0	0.0
Black or African American	14	4.2	7	13.0
Hispanic or Latina/o	22	6.6	1	1.9
Native Hawaiian or Pacific Islander	3	0.9	1	1.9
White or Caucasian	295	88.6	47	87.0
<i>White students</i>	267	80.2	43	79.6
<i>Students of Color</i>	64	19.2	11	20.4
Undergraduate Major				
Biological and life sciences	46	13.8	8	14.8
Engineering	77	23.1	14	25.9
Health	76	22.8	12	22.2
Math and computer science	47	14.1	16	29.6
Physical science	13	3.9	4	7.4
Social science	74	22.2	0	0.0
First-generation students	166	50.9	28	51.9
Disability status				
Cognitive impairment	31	9.3	6	11.1
Mobility impairment	35	10.5	7	13.0
Sensory impairment	20	6.0	4	7.4
<i>Impaired students</i>	66	20.4	13	24.1
Institution				
State College 1 (enrollment~8,000)	62	18.6	9	16.7
State College 2 (~33,000)	81	24.3	14	25.9
State College 3 (~19,000)	81	24.3	13	24.1
State College 4 (~13,000)	50	15.0	6	11.1
State College 5 (~7,000)	59	17.7	12	22.2
Mean age	28.3	—	29.6	—

Note. "Race/ethnicity" and "Disability status" categories show the number of students identifying in each subgroup. Several students identified in two or more subgroups in each category. "First-generation" students are students reporting that their parental guardians have not obtained a bachelor's degree or higher

of the five universities to forward emails from researchers to all identified SSM/Vs in their institutions. Emails included information on the study and a Qualtrics survey link and elicited 333 responses from SSM/Vs in STEM majors. Survey participants received a \$20 Amazon gift card for completing the survey, which took about 15 minutes. Interviewees were recruited through the survey, where respondents were asked if they were interested in qualitative participation. Those who agreed provided contact information and were contacted by a researcher. Zoom interviews with volunteer SSM/Vs used a semi-structured protocol and lasted about an hour. Those who participated in an interview received an additional \$30 incentive.

Measures

Survey Instrument. Quantitative findings from the online survey examined associations between our four focal SSM/V social support variables and a campus belonging variable, helping us answer RQ1. The team developed the online survey instrument using literature on SSM/V academic development and social support, STEM climates and belonging, and egocentric social network measurement (e.g., Burt, 1984). After three content experts validated the survey content, the researchers had several SSM/Vs provide thoughts and questions as they took the survey. The instrument was then piloted with SSM/Vs through a national online panel, with the researchers finalizing the survey after checking answer distribution, response time, and participant feedback.

Campus belonging. Surveys included an established battery to measure the dependent variable of campus belonging—defined as a psychological sense of affiliation, identification, and membership within the campus community (Strayhorn, 2018; Hurtado & Carter, 1997). Participants were asked to indicate their agreement to three items using a 5-point

Likert scale. Our analyses used the standardized average score of these items as a continuous dependent variable representing social capital belonging-oriented returns.

Social support networks. The survey included a section gathering social support network data to measure focal independent variables representing social capital accessibility (Lin, 2001). Based on established egocentric methods, this section began with two name generators asking SSM/Vs to identify significant social ties with whom they discussed important personal, academic, and career matters. The total number of contacts listed by participants to these two questions represented “network size.” Participants were next asked to characterize each listed contact’s role in their life (Burt, 1984). Their responses were used to construct dichotomous educator tie, student tie, and military tie network measures. We used several other measures gathered from survey responses in our statistical models to control for demographic factors shown to influence belonging (Bean & Metzner, 1985; Estrada et al., 2018; Hurtado & Carter, 1997; Terenzini et al., 1996).

Interviews. Qualitative data were used to explore RQ2 regarding the kinds of social support, if any, SSM/Vs believed influenced their sense of campus belonging. The researchers developed a semi-structured interview protocol based on the literature on SSM/V social support, STEM climates and belonging, and our social capital frame. With survey-based network diagrams for student reference, questions centered on listed contacts’ roles, what typical interactions consisted of, and how particular relationships were valuable (or not). These inquiries were meant to document SSM/V social capital development phases (Lin, 2001). Students were also asked about our focal outcome: “In general, do you feel like you belong at [university]?” We followed this question with probes asking students how, if at all, social support facilitated these feelings.

Analysis

Survey Responses. We estimated the ordinary least squares (OLS) regression model of participants' feelings of campus belonging on network size, educator tie, student tie, and military tie network measures. After accounting for appropriate covariates, we first examined the relationship between each network variable and students' feelings of belonging. Since network size typically correlates with other network variables (Perry et al., 2018), we then examined the partial relationship between each network variable and students' campus belonging by including all network variables simultaneously in our model. When analyzing network variables, common model violations (e.g., OLS regression, in particular) can often be more pronounced (Perry et al., 2018). To address this issue, we tested a series of OLS regression assumptions for each analytic model and found no severe violations.

Interview Transcripts. We used a quasi-grounded method to analyze interviews in answer to RQ2. Analysis began with the first author segmenting applicable STEMM SSM/V statements across the transcripts, including all interviewee text speaking to social support, belonging, and feelings of inclusion or exclusion on campus or in STEMM. Once separated, these statements were open coded (Charmaz, 2014). As open coding proceeded, we used the constant comparative method to group open codes by similarity, redefining ever-larger groupings to account for added statements and ideas. After coding all transcripts in this way, we reorganized code groups into more refined categories to develop a final codebook that was then applied to all segments (Saldaña, 2015). Second cycle methods involved rereading transcripts to check codes to student statements and context and then further refining code groupings into larger themes. The first author finalized the organization and definitions of these themes and, as a last step, counted the number

of STEMM SSM/Vs who had spoken to each. Below we provide detailed descriptions of four themes and a table displaying all theme definitions and counts.

Limitations

Findings should be interpreted with several limitations in mind. While this sample is fairly representative of the SSM/V population in Wisconsin public universities, it may not be representative at the national level. Our sampling approach, the survey's 32% response rate, and the self-selected nature of our sample may also limit findings' external validity. Additionally, the study is centered in Wisconsin, a state which does not have a large active military presence. This means the state's SSM/V population is more similar demographically to the wider, mostly White Wisconsin population than to the more racially diverse SSM/V population nationally.

RESULTS

Relationship Between Social Support and Sense of Campus Belonging

Table 2 shows that SSM/V network size (M1) was significantly and positively associated with a sense of campus belonging. Educator ties (M2) and student ties (M3) were also significantly and positively associated with campus belonging. Even when simultaneously taking into account all network variables and covariates (M5), the associations between these three network variables and campus belonging were fairly consistent. We found no significant association between military ties (M4) and campus belonging across models, however.

Social Support Factors Influencing Sense of Campus Belonging

STEMM SSM/V interviewees spoke to several social support dynamics that influenced feelings

Table 2.
Regression of STEMM SSM/V Campus Belonging on Social Support Network Variables

	M1		M2		M3		M4		M5	
	B/SE	p	B/SE	p	B/SE	p	B/SE	p	B/SE	p
Network size	.056** (.020)	.004							.046* (.021)	.031
Educator ties			.315* (.127)	.014					.285* (.130)	.029
Student ties					.322** (.124)	.010			.281* (.123)	.023
Military ties							-.100 (.120)	.404	-.209 (.115)	.070
Female	.100 (.111)	.370	.127 (.114)	.266	.121 (.111)	.276	.147 (.112)	.191	.111 (.110)	.315
Students of Color	.282* (.125)	.024	.256* (.122)	.038	.314* (.126)	.013	.259* (.123)	.035	.301* (.130)	.021
First-generation status	-.040 (.109)	.714	-.031 (.111)	.780	-.025 (.110)	.818	-.035 (.112)	.754	-.022 (.109)	.842
First-year college GPA	-.026 (.045)	.559	-.028 (.045)	.532	-.025 (.045)	.576	-.038 (.046)	.410	-.025 (.044)	.570
Part-time student status	-.357* (.146)	.015	-.336* (.145)	.021	-.270 (.153)	.078	-.354* (.149)	.018	-.278 (.149)	.063
Years enrolled in college (log)	-.006 (.050)	.909	-.020 (.050)	.683	-.026 (.052)	.619	-.016 (.052)	.751	-.039 (.050)	.441
Age (log)	-1.291*** (.303)	.000	-1.278*** (.295)	.000	-1.237*** (.303)	.000	-1.253*** (.301)	.000	-1.304*** (.298)	.000

Table 2.
Regression of STEMM SSMV Campus Belonging on Social Support Network Variables (continued)

	M1		M2		M3		M4		M5	
	B/SE	p	B/SE	p	B/SE	p	B/SE	p	B/SE	p
Student-parent status	.078 (.160)	.625	.099 (.157)	.531	.083 (.161)	.605	.096 (.160)	.549	.125 (.160)	.437
State College 1	.170 (.172)	.323	.206 (.176)	.242	.216 (.174)	.217	.233 (.178)	.192	.160 (.171)	.349
State College 2	-.131 (.158)	.410	-.091 (.164)	.582	-.126 (.160)	.434	-.128 (.165)	.440	-.110 (.161)	.495
State College 3	.062 (.185)	.740	.284 (.185)	.127	.259 (.185)	.162	.277 (.191)	.147	.204 (.182)	.262
State College 4	-.057 (.170)	.737	.008 (.170)	.960	.013 (.168)	.937	.028 (.169)	.869	-.001 (.169)	.996
R-square	.208		.208		.210		.194		.243	
Observations	318		303		303		303		303	

Note. Robust standard errors are in parentheses. Coefficients for constant are not reported in the table. "M1," "M2," etc. represent model 1, model 2.

* $p < .05$. ** $p < .01$. *** $p < .001$

Table 3.
Social Support Themes Influencing STEM SSM/V Campus Belonging ($n = 54$)

Theme	<i>n</i>	Description
Imposter feelings	15	Feelings of intellectual inauthenticity or self-doubt based on the sense that SSM/Vs unfavorably compare to others in STEM, usually due to a combination of background factors and stereotypes about military people and culture
Student friendships	14	Close relationships with other university students offering companionship, study partnerships, and/or the opportunity to relax
Familiar faces	13	A feeling of positively recognizing or being recognized by many members of the campus community
Educator care	12	Expressed attention, concern, guidance, or empathy for student from university instructors or other teaching staff
Campus involvement	11	Activities, including clubs, work, or other extracurricular involvement, taking place on campus
Timing	11	Time as a social support factor regarding how long one has been out of formal schooling, spring (versus fall) entry, missing classes because of military duties, or being older than peers
Veteran support	10	SSM/V encouragement, inclusion, and advocacy from the university, communicated through policy (e.g., military transfer credits) and/or SSM/V-specific support staff
Home/heritage	4	University has been a social focus for student and/or their family for years through home community, athletic fandom, and/or family alumni status
Academics	2	Perceived teaching and learning approach in STEM department (e.g., hands-on vs. theoretical) influencing feelings of social connection with program, career field, faculty, and/or other students

of belonging. All themes from this qualitative analysis are displayed in Table 3. Here we describe four of these themes that speak most closely to RQ2 and our quantitative findings.

Imposter Feelings. Of those interviewed, 15 described how social support dynamics in their lives created “imposter” feelings (e.g., Canning et al., 2020), or feelings of self-doubt and intellectual inauthenticity, that could limit their sense of campus belonging. Often based on perceived differences between military people and those in STEM fields, these feelings were socially motivated in various ways. Several students told us, for example, that there was an intellectual stigma associated with being in the military. “I went to a good public high school,” a student from State College 5

explained, “When I said I was joining the Army, teachers were like, ‘Why? Dumb people join the Army.’” He continued, “It’s a self-limiting mindset: you’ve been told for so long that you’re dumb.” Low expectations, many of these SSM/Vs reported, did not inspire confidence as one went into a STEM major. For other interviewees, imposter feelings grew from the lack of higher education-oriented support growing up. People join the military “out of struggle,” one State College 2 student explained. “I came from a family that made \$12,000 a year. A lot of military people don’t come from education, and going into STEM has to come with confidence in yourself educationally . . . people think it’s hard.” This self-doubt, which SSM/Vs said could also be fostered if one came from a

blue-collar background, could lead to the sense that one did not compare well intellectually to other college students, especially those in arduous STEM majors. STEM seemed to be for “the more book-oriented people,” as another State College 5 SSM/V put it. “I mean, my dad was a cabinet maker.”

Student Friendships. A slightly smaller group of interview participants ($n = 14$) told us that their sense of belonging was linked to whether they had developed friendships on campus. Interviewees said such friendships offered a direct connection to the social and academic life of their university, as well as camaraderie, work partnerships, and the opportunity to relax. In some cases, friendships also helped SSM/Vs overcome their apprehensiveness about whether they could fit in among younger civilian students who often misunderstood or stereotyped service member and veteran experiences. According to SSM/Vs, one’s affinity for others in their STEM major program, in particular, could have an outsized impact on how quickly and easily one developed ties with non-military students. For example, one first-year student at State College 4 had just begun classes and said she already felt a strong sense of campus belonging. She had quickly developed relationships with students in her nursing cohort, many of whom were service-oriented and all of whom took their classes together. “We’re all close,” she told us. “It really happens fast.” Another student, however, told us that she had not meshed well with other students in her science program at State College 2, many of whom did not seem to understand her military experiences. She had only recently started to feel like she belonged when she began a campus job with several more-understanding students. “Now I’ve got something that really connects me to the school,” she reported. Another SSM/V at State College 1 said she had left a former institution for this very reason: “I really didn’t have any

super close friends. I’m just sitting in my room doing homework all the time.”

Educator Care. A group of 12 STEM interviewees told us that they felt a closer connection to their campus community because of how much faculty members seemed to care for them and their educational success. While SSM/Vs discussed different scenarios in which this kind of care stood out, it typically involved faculty members making a concerted effort to show students they had thought about them as individuals. Such experiences made students feel the institution was invested in them and their futures, even if SSM/Vs often did not fit the traditional student mold. Educator care happened for SSM/Vs in STEM and non-STEM courses alike. “I saw an old professor, and he remembered that I was going to basic training, and he asked me about it,” one State College 3 noted. The student explained further:

He taught five massive English classes in fall and remembered that . . . it can be hard to feel a sense of belonging to such a big university, but then, those little moments, you’re like, ‘You know what? I do belong here.’

In another example, a student at State College 1 told us that a STEM faculty member singled her out for help, sending her information and advice on different research opportunities: “She went, ‘I noticed your grades are good. Maybe you’d be interested in this program.’ I mean people are looking out for you there, so you kind of feel like you do belong.”

The lack of faculty attention, however, could have the opposite effect. Several students at State Colleges 2 and 3, both large universities, remarked that the faculty did not have the time, energy, or interest to work with them to the students’ satisfaction. One State College 2 SSM/V, for instance, unfavorably compared his current STEM faculty to instructors he had studied under in community college. “Instructors there

actually wanted to help you . . . and they would work with you,” he explained. State College 2, however, seemed more like a machine designed for graduate student and faculty research: “Here it’s an every-man-for-himself mentality.”

Veteran Support. Among those interviewed, 10 told us that their university’s support for service members and veterans was important to belonging. Tangible, positive interactions with university systems or personnel, in this regard, made a real difference. One student said, for instance, that State College 4 policies alone made him feel at home. “They have priority registration for veterans,” he explained. “They’re just a veteran-friendly university.” Another student, however, told us State College 2’s transfer credit policies showed a lack of respect for military experiences, particularly technical training she thought should transfer right to her STEMM major. “The university doesn’t recognize the trainings that we go through that translate perfectly,” she said. Interviewees reported that having university service professionals dedicated to military-affiliated students could also be influential. As staff who better understood SSM/V experiences, these coordinators were able to directly support students, whether through outreach or by organizing events bringing veterans together. In a few instances, however, we found SSM/Vs who purposefully shied away from veteran-centered activities on campus. “I belong, but it has nothing to do with being a veteran,” one State College 4 student told us. “I don’t engage with the veteran community . . . it’s really awesome to be able to separate and just be a student.”

DISCUSSION

These results confirm and extend prior research in several ways. Our regression analyses indicated that STEMM SSM/Vs with larger support networks have stronger feelings of campus belonging, here conceived as a sense

of campus membership, connection, and belonging-oriented social capital returns (Lin, 2001) necessary for academic and intellectual achievement (Strayhorn, 2018). While these results align with years of research linking network size to greater levels of social support (Perry et al., 2018), they break new ground with regard to research on SSM/Vs in general and those in STEMM contexts specifically. Our findings also indicated that SSM/Vs who have relationships with university faculty and staff or fellow students were more likely to access and mobilize campus belonging-oriented social capital. This finding reaffirms research showing that faculty (Estrada et al., 2018) and peer support (e.g., Thomas, 2000) connect to deeper involvement and confidence in STEMM fields among marginalized students, as well as studies underlining the importance of student–peer and student–faculty socio-academic integrative moments to nontraditional students who spend less time on campus (Deil-Amen, 2011).

Interviewee perspectives add experiential depth to correlational findings. In “Imposter Feelings,” several SSM/Vs spoke to feelings of anxiety, self-doubt, and inauthenticity, based in part on military social affiliations and stigmatization, that made them feel like they did not fit in STEMM. This, in turn, limited their sense of campus belonging. While nothing, to our knowledge, has been written about the imposter phenomenon among SSM/Vs, research has shown these feelings are prevalent among women, first-generation students, African American students, and Latina/o students and can be a detriment to belonging as well as persistence in STEMM fields (Canning et al., 2020; Chrousos & Mentis, 2020; Terenzini et al., 1996). Importantly, these and other qualitative results also show how multiple identities, based on student military affiliation, socioeconomic class, part-time student status, or age, can intersect to constrain students in STEMM fields in ways their military status alone does

not. This is particularly salient, again, when students suggested their status as the children of non-college-educated, working-class parents, in addition to their military experiences, made them feel like they did not belong in academically rigorous STEMM courses. Though we could not describe it in detail due to space limitations, intersectional identities and belonging are also important to the “Timing” theme, which implicated age, delayed enrollment, part-time student status, and sudden military activations as alienating factors in college (Barry et al., 2014; Borsari et al., 2017).

More positively, interviewees reported on the specific ways interactions with faculty, academic advisors, and veteran coordinators could improve their sense of belonging. Many told us it was beneficial when educators singled them out as individuals and communicated concern for their success, for example. Others, however, said this kind of attention was difficult to obtain in our two larger universities, underlining the role institutional integrity can play in fostering student interpersonal connections (Braxton et al., 2011). Additionally, STEMM SSM/V interviewees also reported feelings of separation associated with having few student friends, highlighting research suggesting not only that SSM/Vs sometimes have trouble forming relationships with traditional students (Whiteman et al., 2013) but also that various social incongruities—based not only on military-affiliation but also on intersectional identities like class or first-generation status—can lead to feelings of disconnection (Livingston et al., 2011).

It is notable that quantitative results did not show any significant association between military social ties and campus belonging, despite ample field research demonstrating the importance of service member/veteran social support to SSM/Vs (e.g., Ackerman et al., 2009; Borsari et al., 2017). While further study is needed, this result may demonstrate conflicting needs among STEMM SSM/Vs. For some, as reported

above, college represented an opportunity to go in a new direction or enjoy a conventional student experience. Imposter feelings associated with stereotypes of military-affiliated students may also be an additional weight that SSM/Vs do not want to bear. In these and other cases, military ties could be a detriment to feeling like one fits in local campus communities, especially those geared toward traditional students (Borsari et al., 2017, pp. 167–168). Further, as Strayhorn (2018) has pointed out, not all social circles boost feelings of campus belonging nor automatically lead one to scholastically successful behavior (pp. 32–33). Indeed, tight-knit military ties may provide SSM/Vs with feelings of camaraderie and fellowship even as they foster distance from the wider campus environment.

This point highlights social capital returns, like feelings of belonging, are context dependent. Here, Lin’s (2001) social capital theory proves a useful framework for understanding how different aspects of social support connect to STEMM SSM/V campus belonging. Quantitative findings suggested that certain forms of accessibility—namely larger relationship circles and relationships with educators and fellow students—predict returns represented by a student’s sense of campus belonging. Qualitative findings, however, show how SSM/V military backgrounds (position) can interact with STEMM disciplinary environments and stereotypes about military members (structure) to discourage relationship building (accessibility). Further, qualitative findings provided details about how other potentially helpful social ties are mobilized to obtain campus belonging-oriented returns through everyday interactions such as hanging out with fellow students; talking to thoughtful, attentive professors on campus; or seeing evidence of institutional integrity such as transfer policies that include provisions for military credit and veteran-friendly procedures. These findings

demonstrate the implications of not having close student or educator relationships, even among those with strong off-campus networks.

IMPLICATIONS AND CONCLUSION

Results provide university educators—including college leaders, academic and career counselors, student affairs professionals, STEM administrator, and STEM faculty—useful information for improving SSM/Vs' feelings of campus belonging and engagement. First, those working on STEM student transitions into college should reach out to SSM/Vs early and consider developing SSM/V-focused university or department orientation sessions, which have been shown to foster engagement, social networking, and the sense of entering a veteran-friendly space among SSM/Vs (Semer & Harmening, 2015). Leaders, counselors, student affairs professionals, and faculty on campus can also seek to build social environments that are more hospitable to SSM/Vs by becoming more knowledgeable about military culture and education benefits, either by developing relationships with veteran coordinators on campus or by participating in Green Zone training if it is available (Nichols-Casebolt, 2012).

Second, university educators can actively work to help SSM/Vs develop important social ties on and around campus. They can do this by brokering ties between SSM/Vs, educators, other students, employers, or military-affiliated alumni through informal introductions, student organization sponsorship, and other programming (e.g., social events, service fairs) focused on SSM/Vs in STEM. Educators can also inform STEM SSM/Vs of the importance of developing larger social circles with fellow students and university educators. This kind of SSM/V network intentionality (Moolenaar, 2012) would lead to more SSM/Vs seeking to develop social ties that research has suggested help them in college STEM contexts. Third,

depending on SSM/V preferences, counselors can encourage STEM academic and career plans that take advantage of students' military skillsets like adaptability, discipline, and teamwork (Semer & Harmening, 2015), taking care to develop connections with local veteran scientific and technical employment representatives and outreach specialists (see Kelley et al., 2013).

While student services are important to fostering more socially supportive environments, research indicates that the classroom is perhaps most significant to the social integration of students who are older or have off-campus work or family responsibilities (Deil-Amen, 2011). Considering previous research and our own findings, SSM/Vs in STEM will feel a greater sense of belonging when classroom faculty show a concerted effort to support their success, understand and respect their unique experiences, treat them as individuals with the intellectual capacity to excel, and encourage peer-to-peer collaboration in class (Brown, 2019). Ultimately, educators, as well as fellow students, should remember that individual SSM/Vs in STEM have a range of identities, of which their affiliation with the military represents only one.

This study represents a first step in this research area. Future work with larger samples of STEM SSM/Vs from geographically dispersed institutions would allow a more in-depth analysis of social support and belonging among multiple intersecting racial, socioeconomic, and gendered identities in more diverse contexts. The field would also benefit from longitudinal studies centered on better understanding how STEM SSM/V social support and campus belonging influence university persistence and career satisfaction after graduation—something for which SSM/V scholars have long been calling (e.g., Barry et al., 2014). Further, scholars and educators would come to better understand what characteristics and qualities make STEM SSM/V experiences unique by

comparing STEM SSM/V groups to non-STEM SSM/Vs (see, for example, Barry et al., 2021) as well as to STEM and non-STEM students who have not been affiliated with the military, both nontraditional and traditional.

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