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Transition and the Troubled Giant: Opportunities for Colleges and Universities to Invest in Veterans

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Veterans are entering higher education in large numbers. Some colleges have prepared a welcoming, supportive environment, while others have not. A recent national study asked veterans who are enrolled in college, and service members who are in the process of transitioning out of the military, about the critical factors that influence their decisions about postsecondary education. Researchers interviewed 69 veterans and service members about their decisions to enroll in postsecondary education. During interviews, participants drew cognitive maps showing the resources and supports most important for them to reach their goals. This interactive process invited participants to apply directional and weighted numerical values that quantify the relationship between various supports and resources. The research team computed the weight and direction and used the data to test possible scenarios for higher education to better support veterans who are students, especially those pursuing STEM degrees and careers.

Keywords: student veterans, higher education, military transition, post 9/11 veterans, STEM education, fuzzy cognitive mapping

Introduction

With over one million veterans using their educational benefits in 2014 (U.S. Department of Veterans Affairs, 2014), higher education has an opportunity to support transition from military to civilian life through postsecondary education. As colleges and universities reach out to veterans, it is essential they understand veterans as adult learners with unique sets of prior experiences affecting their daily lives. Higher education's response to increasing numbers of military veterans enrolling on campuses and online has been mixed: The "troubled giant" (Weerts, 2007; Thelin, 2004) has not uniformly accepted and welcomed military veterans. Scholar John Thelin referred to higher education as a "troubled giant" due to the drastic increase in the number of people going to college, demographic changes, increased regulation, rising cost of tuition, competition from proprietary sector, and a flooded academic labor market (2004). Higher education has not always been troubled or a giant, nor has it always made transition challenging for military veterans. During World War II,

like all other public sectors, higher education was engaged in the war effort. After the war, the G.I. Bulge led to dramatic transformation of college-going from an opportunity of privilege to an open access system serving a wide range of ages and educational goals (Thelin, 2004). Once again large numbers of veterans are transitioning to civilian life and using the G.I. Bill to go to college. Only this time, higher education is more complex to navigate and is less permeable than in the years following WWII. The growing number of veterans returning to higher education is catching many colleges and universities unprepared to provide supportive services. When veterans have a service-connected disability, higher education lacks sufficient experience to equip them with the reasonable accommodations needed for degree completion and success (U.S. Government Accountability Office, 2009). In addition, the changing role of higher education in America's economy and job market, combined with the particular needs of Iraq and Afghanistan veterans, creates an urgent need for colleges and universities to support veterans' transition and persistence toward a degree.

Veterans in STEM: Critical Analysis of the Factors Affecting Pathways to STEM Careers is a research study funded by the National Science Foundation and led by the University of Missouri-Kansas City. This national study asked military veterans with disabilities who are enrolled in college and service members who are in the process of transitioning out of the military about the critical factors that influence their decisions about postsecondary education. Through a social ecological framework, this study was designed to investigate both veteran-specific and context-specific variables using fuzzy cognitive mapping. By engaging service-members in out-processing and undergraduate veteran college students with disabilities majoring in STEM, this research study aimed to clearly identify and describe in detail the barriers veterans are experiencing and the implications for college-level supports and instruction. These disabilities most frequently included the symptoms of post-traumatic stress or traumatic brain injury such as learning, memory, communication, organization of thought,

sensory, and/or vestibular challenges, which are often 'invisible' or unrecognized during the transition from military to civilian life.

Literature Review

Veterans transitioning to college and university are different from the World War II veterans whose numbers spiked enrollment and transformed higher education. For post 9/11 veterans, traumatic brain injury (TBI) and post-traumatic stress disorder (PTSD) have become signature injuries, differentiating them from previous generations of veterans and presenting new challenges to the systems that support veterans. Exposure to improvised explosive devices (IEDs) and mortar attacks puts soldiers at increased risk for TBI, and because the War on Terror has lasted so long, many veterans have been deployed several times, multiplying their risk for injuries and stress from combat trauma and compounding strains on family life (National Center for Veterans Analysis and Statistics, 2011). The 2011 American Community Survey of the Census (ACS) estimates that 28.7% of all veterans in the United States have a self-reported disability (U.S. Census, 2011). Especially among post 9/11 veterans, "invisible" injuries are prevalent; a growing number of military personnel are diagnosed TBI due to blast injuries; nationally, the number has risen steadily from about 11,000 in 2001 to over 33,000 in 2011 (U.S. Department of Defense, 2012). The Veterans Health Administration also reported in a 2011 study that 50% of Operation Enduring Freedom/Operation Iraqi Freedom (OEF/OIF) veterans had mental health challenges including PTSD (29.5%), acute stress disorder (6.6%), anxiety, depression, and other mental health disorders (11.5%) (Frayne, Chiu, Iqbal, Berg, Laugani, Cronkite, Pavao, & Kimerling, 2010; Nazarian, Kimerling, & Frayne, 2012). Additionally, in a 2011 Pew Research Center study, 37% of post 9/11 veterans said that regardless of diagnosis, they believe they have suffered from PTSD, compared with just 16% of veterans from earlier eras. Veterans who were in direct combat report an even higher rate, at nearly 50%. The same study found that 48% of married post 9/11 veterans report marital strain, 47% felt frequently irritable

or angry, and 44% had trouble reentering civilian life (Pew Research Center, 2011). The issues facing our newest veterans are complex and cross multiple systems. As such, they require cross-system interventions and collaborative solutions.

Disabilities related to military experiences bring increased barriers to transition to higher education, such as awareness of and access to benefits and accommodations and misperceptions or lack of information about veterans' needs (Do-It (Disabilities, opportunities, internetworking, and Technology), 2008; Elliott, 2011; American Council on Education, 2010; Jenson & Petri, 2011; Shackelford, 2009). Service-members transition from the military and many want to use the GI Bill they earned to go to college. Few service-members transition from the military and academically pick up where they left off. It has been years since they figured out how to "solve for x." Prior experiences of trauma affect learning; veterans need structure, accommodations, and strategies for overcoming or persisting when facing challenges (Cook & Kim, 2009; American Council on Education, 2011; Burnett & Segoria, 2009; Shackelford, 2009). Higher education has an opportunity to reach out to veterans and to recognize the growing numbers pursuing degrees as a call to innovate and change to meet the demand.

Veterans in college disclose challenges with adjusting to a college culture that differs greatly from the highly structured military culture (Cook & Kim, 2009). Some veterans may perceive a lack of accountability in the academic culture because there is no clearly discernable chain of command (Griffin & Gilbert, 2015; Glasser, Powers & Zywiak, 2009). They miss the camaraderie they experienced in the military; they feel like outsiders among the 18-22 year-old traditional campus population; and they sense that faculty does not understand them. In addition, those with a diagnosis of PTSD were found to experience a greater sense of alienation within the campus environment (Norman, Rosen, Himmerich, Myers, Davis, Browne, & Piland, 2015; Elliott, Gonzalez & Larsen, 2011).

Difference in culture is not the only difficulty facing veterans transitioning to college; financial difficulties often add another layer of stress for student veterans. While most are happy to have the financial support of the GI Bill, they may be unprepared to deal with the bureaucracy around the application process, and the unpredictable delays in receiving funds. Students may find themselves dropped from classes due to late payments, (Norman, et al., 2015) or assuming more out-of-pocket expenses than they can afford, leading to credit card debt (Griffin & Gilbert, 2015; Ackerman, DiRamio, & Garza Mitchell, 2009). Debt compounds stress related to transition.

Veterans using the GI Bill have a limited amount of time and limited financial resources to complete their studies and want to take the most efficient route possible. Most veterans believe college credit for military training and occupational experiences should be more broadly accepted (American Council on Education, 2010; Cook & Kim, 2009). The fact that years of military training and experience may translate into few, if any, credits toward a degree, and the lack of consistency and transparency around the transfer policies at some institutions becomes a source of disappointment and frustration for many veterans (Griffin and Gilbert, 2015).

While there are challenges, there are also supports and resources available at many colleges and universities that are beneficial to student veterans. To overcome the barriers, student veterans report the importance of connecting with other veterans (American Council on Education, 2010; Burnett & Segoria, 2009; Do-It, 2008; Madaus, Miller, & Vance, 2009; Vance & Miller, 2009; American Council on Education, 2010), more sensitivity among faculty to veterans' issues (American Council on Education, 2010; Burnett & Segoria, 2009; Cook & Kim, 2009; Do-It, 2008), and better coordination between the administrative offices and staff that work with veterans (Norman, et al., 2015). More important than having a dedicated physical space (e.g., veterans center), was the existence of a person or persons in a leadership capacity who understood veterans' issues and could serve as an advocate. Veterans found they were most supported by caring individuals within an

institution who had both the knowledge and the authority to advocate for them and to bend conflicting policies when necessary (Griffin and Gilbert, 2015).

Many barriers face veterans transitioning from the military to higher education; and higher education has many opportunities to be veteran supportive. The Veterans in STEM study is a first-of-its kind, national study to engage service members and veterans in fuzzy cognitive mapping (FCM) about what leads to – and detracts from – veteran success. As a research methodology, FCM is particularly adept at modeling complex problems, such as veterans going to college and colleges being unprepared to provide needed supports. An appealing feature of FCM is that the college students and transitioning service-members are the experts on veteran success and it is their cognitive maps that compose the model. Having a model against which others can test scenarios based on veterans' experiences is groundbreaking in its breadth and directness.

The roots of FCM are in social science and artificial intelligence; FCM provides a way to take qualitative cognitive maps of the social sciences and make them computable (Jetter & Schweinfort, 2011). Once computable and combined, the cognitive maps form a system model. This methodology has advantages for research studies such as Veterans in STEM: (1) FCM processes are intuitive, engaging and hands-on for participants. (2) It is possible to build onto the model by adding new stakeholders and participants. (3) The model can serve as a planning tool. Planners can answer "what-if" questions using the resulting model to predict how stakeholders may respond to changes. As such, FCM provides a simulation environment for planners and researchers to analyze consequences of a variety of scenarios, which minimizes unintended consequences for stakeholders (Jetter and Schweinfort, 2011).

FCM has a growing reputation across a variety of fields (Papageorgiou, 2011), such as strategic information planning, environmental research, and health care (Jetter & Schweinfort, 2011). For example, Ozesmi and Ozesmi (2004) used FCM as a collaborative modeling methodology

to explore stakeholder views about large dam projects. Jetter and Schweinfort (2011) used FCM to integrate the partial knowledge of multiple stakeholders to form a more complete picture of solar power.

The Jetter and Schweinfort framework (2011) is the most widely accepted framework for FCM and it structures the process around six steps. The recommended steps, which Veterans in STEM followed, are: (1) identify clear needs for the information and define the scope of the FCM project. (2) Make plans for the study such as identifying participants and outlining knowledge elicitation techniques. (3) Make cognitive maps and relevant information about the anticipated behavior of the system represented by the map. (4) Make a conceptual design of the model. (5) Make a detailed design of the FCM model, (6) Run tests, interpretation, and validation of results (Jetter, & Schweinfort, 2011).

Aside from Veterans in STEM, one other published study has used FCM with veterans to model a complex situation. The study focused on homelessness and selected FCM because of the methods ability to capture, "greater degrees of dynamism and complexity," as well as its capability for scenario testing (Mago, Morden, Fritz, Wu, Namzi, Geranmayeh, Chattopadhyay, & Dabbaghian, 2013). Interesting, the conclusions showed that education had the greatest force in the model to positively affect homelessness among veterans (Mago et al, 2013).

Methods

Gaining prominence in the fields of engineering, business, and information technology is a method of making qualitative cognitive maps computable, fuzzy cognitive mapping (FCM) (Kosko, 1986; Papageorgiou, 2011; Jetter and Schweinfort, 2011). The steps of FCM include gathering qualitative data from key informants to construct cognitive maps. As part of the maps, the key informants apply directional and weighted numerical values quantifying the relationships between major and minor factors. With the directional and weighted relationships added to the cognitive

maps, the maps from multiple responders can be integrated into a model. With the weight and direction to the relationships between major and minor factors computed, the values can be adjusted to provide if-then scenarios for hypothesis generating and simulated testing.

Research Question. This study was designed to address the following research question: What are the critical factors (or concepts)[1] reported by veterans with invisible disabilities influencing their decisions to enroll and persist in STEM postsecondary undergraduate programs?

Sample. The target population of this study is post 9/11 veterans experiencing stress and challenges related to their time in service, which are often invisible or unrecognized during the transition from military to civilian life. These include TBI, PTSD, depression, and other mental/emotional health challenges. Military veterans and servicemen and women preparing to transition to civilian status participated in the study. A purposeful sampling approach was used to recruit participants from geographical locations across the United States and at both pre- and post-transition stages. Purposeful sampling places the emphasis on understanding varying perspectives yet focused on a shared attribute (Sandelowski, 2000; Patton, 1999). Modeling methodologies, and in particular FCM, assumes and relies on 'expert knowledge for construction of a valid and viable model (Gray, Zanre, & Gray, 2014). Purposeful sampling is an approach to identifying the key attributes of 'experts' and recruiting accordingly. In the case of Veterans in STEM, current veteran college students and military service men and women preparing to transition out of the military in college were identified as the 'experts' for the construction of a model depicting a system of factors either support or detracting from their success. Researchers hypothesized variance in pre- and post-military transition veteran perspectives due to where the experiences were occurring and phase of decision-making regarding plans after the military, during college, and preparation for the workforce. A total of 69 individuals participated. A third of the participants (33%) were active duty status and the rest were either civilian status or in the Reserve or National Guard. Participants reported

experiencing a range of conditions that can be potentially disabling, including: psychological conditions; mobility impairments; health conditions; TBI; sensory impairments; and learning challenges. While participants were interviewed in five locations, they reported fifteen home states, representing east and west coasts, Hawaii, Midwest, South, and New England regions. Table 1 below displays participants' demographics.

Table 1. Participant Demographics

	n	%
Gender		
Male	57	81%
Female	9	13%
Declined to Report	4	6%
Ethnicity		
Hispanic or Latino	8	11%
Not Hispanic of Latino	55	79%
Declined to Report	7	10%
Race		
Asian	4	6%
Black or African American	8	11%
Native Hawaiian or Other Pacific Islander	1	1%
White	43	61%
Multiracial	5	7%
Declined to Report	9	13%
Age Group		
22-25	12	17%
26-35	37	53%
36-45	8	11%
45 and over	8	11%
Declined to Report	5	7%
Military Service Status*		
Active Duty	23	33%
Reserve or National Guard	9	13%
Previous military service	36	51%
Declined to Report	4	6%

*Multiple categories could be marked.

Model development. The purpose of the Veterans in STEM project was to develop a model representing veteran perspectives to inform colleges and universities in the design and delivery of

services and supports. In particular, the project focused on veterans who were experiencing an array of post-transition challenges affecting, or with potential to affect, their college success, specifically in attaining a degree in a STEM field. Using FCM methodology, individual veteran perspectives were integrated to form a holistic model of the critical factors leading to, or detracting from, veteran success in STEM degree attainment and preparation for STEM career.

Conduct interviews and capture individual cognitive maps. The process of data collection began with a face-to-face interview. Using the following open-ended questions, the purpose of the interview was to start the discussion about personal experiences and perceptions affecting their success.

1. What are your education and work plans?
2. What types of transition resources have been offered to you or did you receive when you were leaving the military? Which resources have been helpful and not helpful?
3. What would a veteran-supportive college look like?
4. What types of resources have been available to you in college? Which resources have been helpful and not helpful?
5. What are specific factors that you think lead to veteran success in STEM education and careers?

As main points and resources (concepts) were identified, they were noted on post-it notes. Following the interview, the participant used the post-it notes to create a graphic representation showing how the concepts relate to each other and to success in degree attainment and preparation for STEM career. To complete the graphic representation (map), the participant drew lines connecting post-its (concepts) and added arrows to each line to indicate the direction of relationship (a concept leading to another concept or a concept detracting from another concept). The last step of completing the map was to indicate the relative importance (weight) of the relationships between concepts using a six-point scale (i.e., strong positive, moderately positive, weakly positive, weakly negative,

moderately negative, and strong negative). With permission from the participant, the interview and mapping process was video recorded, and recordings were used to clarify the participant's perspective as needed.

Review and clean data. The following steps were taken to prepare the data for analysis:

1. Digital replications of the hand-drawn maps were made using Mental Modeler (2014)
2. The concepts and relationships among concepts were clarified by reviewing the video recordings
3. An adjacency matrix for each map consisting of the concepts and numerical representations of the relationships among concepts was made.

Find commonalities among individual maps. In individual maps, concepts were labeled by the participant, which led to variability in terminology, but not necessarily in definition. Across the 69 maps, participants identified a total of 837 concepts leading to veteran success. However, most of these concepts were different ways of saying the same thing. Thus, researchers established a process for combining concepts. For example, one participant identified "TAPS," another "Transition GPS," and another "required transition training," which became the concept "Military provided transition training." To make these determinations, researchers listened to the original interview and condensed concepts, which were determined to mean the same thing into like terminology. After combining similarly defined concepts based on how the participants discussed them, researchers established a final set of 55 concepts. The following steps outline the process used to create a master list of concepts while retaining the definitions provided by the participants. This master list of concepts was used to integrate maps and form an overall model.

1. Concepts were examined based on individual definitions and function in the individual map
2. Like-concepts were recoded into common terminology
3. Individual maps and adjacency matrices were adjusted to use the common terminology

Integrate individual maps into an overall model. After applying the common terminology, researchers integrated the individual maps to form an overall model. The overall model resulted by mathematically averaging the individual matrices into one matrix.

Test the logic and responsiveness of the model. In the FCM process, the models built through data collection are used to inform problem solving. To ensure that the model is robust enough to serve as a foundation for credible problem solving, the concepts were tested at positive and negative extremes to see how the model responded. With of the logic tests run, the results showed the expected extreme effects on the outcome variable of veteran success.

Model validation. The last step of the model development was to validate the overall model as responsive to field-defined recommendations. First, program and policy recommendations from multiple sources were reviewed to form hypotheses (scenarios) to apply to the model. Second, stakeholders (a) responded to the set of 55 concepts and their definitions, (b) responded to the model, (c) provided feedback on the response of the model to the applied scenario based on program and policy recommendations, and (d) generated a set of stakeholder-defined scenario to apply to the model. Lastly, the stakeholder-defined scenario was applied the model and results were discussed. The model behaved in expected ways and the stakeholders agreed the model is a valid decision-making tool. Additionally, due to the qualitative component of the study, an external audit was conducted to check for researcher bias and examine the logic in the chain of reasoning leading to resulting model and researcher interpretations (Cutcliffe, & McKenna, 2004). The auditor received an orientation to the study purpose and methodology; reviewed study files and chain of reasoning, and verified alignment between raw interview data and conclusions. In summary, the audit showed research was conducted with fidelity and the findings are credible and valid.

Results

In the 69 maps analyzed, the average number of concepts was 16.65 ± 4.13 in the range of 9-31 concepts. The maps had on average 20.83 ± 6.35 connections. The overall model includes 55 concepts and 518 connections. Due to the large number of concepts, researchers clustered the concepts into categorical domains in order to make sharing and discussing the model with stakeholders easier. These clustered concepts have no bearing on the functionality of the model; they are simply a way of grouping like concepts to more readily understand the model. Because the clustering emerged from the veteran-identified concepts, the clusters point to an interesting array of important considerations for veterans.

Examining the functions of the concepts in the overall model tells a story of veteran success in STEM education toward STEM employment. The most important concepts in the cognitive maps can be determined by looking at centrality values (Özesmi and Özesmi, 2004). High centrality indicates a concept that has great importance in the cognitive map. Concept indegree indicates that the concept is affected very much by other concepts. The eight concepts with the highest indegree were: (1) personal factors; (2) education funding (veteran specific); (3) job search / placement support; (4) college peer connections (veteran specific); (5) (finding) internships; (6) clear academic pathways for veterans; (7) personal/family resources; and (8) financial stability. Concept outdegree indicates that the concept affects other concepts very much. The eight concepts with the largest outdegree were: (1) military provided transition training; (2) education funding (veteran specific); (3) centralized college resources (veteran specific); (4) personal factors; (5) faculty/staff with military experience; (6) college peer connections (veteran specific); (7) personal/family resources; and (8) stigma. Indegree and outdegree were calculated by averaging the absolute value of the weight of inputs and outputs. Centrality was computed as the sum of indegree and outdegree. Table 2 below

shows the concepts in each cluster, listed in order from most central to least central, within each cluster, in the model, with representative quotes.

Table 2. Clusters, concepts, and representative quotes

Cluster	Concepts, Ordered Most Central to Least Central	Representative Quotes
Personal/ Community	Personal factors, personal/family resources, VA services, health services (VS)*, family/friend/ community support, community resources, assistance navigating resources (VS), awareness of resources (VS), community services	"Day care at college would be very nice. I am doing VA Work Study for the extra income. It's difficult–I do this so my wife can also go to school. It is very stressful on the family–I know of people who have almost gotten divorced. It is very stressful–people neglect family to study"
Transition	Military provided transition training, military training transfer credits, military provided transition counseling, military/college collaboration, veteran benefits counseling	"Not a big fan of TAPS. Caters more to 20 year retiring soldier. Doesn't explain to soldiers how to transition very well into a university." "Use of military experiences as credits for college. Right now credits waived for PE for all documented military training. With my job, I almost have an associates but it won't transfer in."
Connecting	College peer connections (VS), community peer connections (VS), college peer connections, peer mentor (VS), community attitude toward veterans, community peer connections	"Initially when I came here I felt a little disconnected. Through SVO I found friends and people with same major and have dealt with and are dealing with the same thing. We are trying to get more veterans participating with us."
Finances	Education funding, education benefits counseling, financial stability, funding options (non-military)	"I wouldn't have considered college without GI Bill. Especially the way it was restructured for Post 911 GI Bill was important for me. My biggest barrier has been financial." "I have more financial responsibility and things to worry about in addition to trying to go to school. Different from 18-year old embarking on college."
Navigating college	Centralized college resources (VS), clear academic pathways for veterans, convenient course options, academic counselor (VS), college orientation course (VS), course sections for veterans, unauthentic education opportunities**	"It needs to be centralized. It is central to basically everything that a Veteran needs. Disabled student services, student services, etc. right there." "Most important to have at the college I think goes back to someone there to talk them through the ins and outs."

University services	Comprehensive academic supports, Learning supports (VS), disability support services, access to technology, accommodations	"Anyone who has any disabilities from the military. Coming out of 10 years of war [...], there may be soldiers who have developed learning disabilities after having concussions–injuries that changed the mind."
Attitudes toward veterans	Faculty/staff with military experience, barrier: stigma (ageism), employer values military experience, faculty attitude toward veterans, faculty attitude toward veterans (barrier), college value veterans as students	"There is still veteran stereotyping. Either we all have PTSD or we are all militaristic pigs. Neither of which are true." "Faculty will sometimes ask questions that are triggers for PTSD such as have you killed someone ... faculty who were very political and have made class uncomfortable for veterans."
STEM Industry	Job search/placement support, internship, job preparation resources, STEM job fairs, STEM industry/college collaboration, STEM industry mentor, Networking with STEM industry, STEM career orientation	"Industry oriented college education–What I don't see much of is businesses taking a skill set they know a veteran has, focusing it in an area the veteran wants, and leading the veteran through training/degree. We will hire you now, pay you a small stipend, and then hire you at the end."
*(VS) Veteran Specific ** factors in red were barriers		

Centrality was a function of both how many participants included a concept in their cognitive map and how strongly the connections to and from that concept were weighted. Twenty-one concepts showed centrality values above the average value (>0.36). Of these concepts, 17 concepts had indegree values greater than average (>0.23) and 16 concepts had outdegree values greater than average (>0.13). The following 11 concepts had greater than average values across all three measures. Their importance to the overall model was due to veterans including these concepts in their maps and assigning strong values of connectedness to other concepts, all leading to veteran success.

- Education Funding (VS)
- Personal Factors
- Military Provided Transition Training (TAP)
- College Peer Connections (VS)
- Job Search/Placement Support

- Personal/ Family Resources
- Centralized College Resources (VS)
- Internship
- Education Benefits Advising
- Financial Stability
- VA Services

This list of 11 concepts represent the following seven clusters: (1) Personal/Community; (2) Transition; (3) Connecting; (4) Finances; (5) Navigating College; (6) Attitudes toward Veterans; and (7) The STEM Industry. The most important concepts in the cognitive maps can be determined by looking at centrality values. High centrality indicates the concept has greater importance in the cognitive map. Table 3 below shows the function of the top 15 concepts in the overall model, ordered by centrality. The cells in the table are shaded to help show how the concepts fit together. Because the table is ordered by centrality, the concepts are shaded from light blue to dark blue, with light blue having the greatest centrality. Those same concepts are similarly shaded in their appearance in the outdegree and indegree columns, which are also ordered largest to smallest. Concepts that are shaded gray have strong outdegree and/or indgree but not strong centrality.

Table 3. Function of top 15 concepts in the overall model

Concept Outdegree (affects other concepts)	Concept Indegree (affected by other concepts)	Centrality
Education Funding (VS)	Military Provided Transition Training (TAP)	Education Funding (VS) (1.30)
Job Search/Placement Support	Education Funding (VS)	Personal Factors (1.21)
College Peer Connections (VS)	Centralized College Resources (VS)	Military Provided Transition Training (TAP) (1.11)
Internship	Personal Factors	College Peer Connections (VS) (0.89)
Clear Academic Pathways For Veterans	Faculty/Staff With Military Experience	Job Search/Placement Support (0.78)
Personal/ Family Resources	College Peer Connections (VS)	Personal/ Family Resources (0.77)

Financial Stability	Personal/ Family Resources	Centralized College Resources (VS) (0.75)
Military Provided Transition Training (TAP)	Internship	Internship (0.75)
Centralized College Resources (VS)	Stigma	Faculty/Staff With Military Experience (0.62)
VA Services	Military Training Transfer Credits	Education Benefits Advising (0.53)
Community Peer Connection (VS)	Military Provided Transition Counseling	Financial Stability (0.52)
Education Benefits Advising	Education Benefits Advising	VA Services (0.51)
Job Preparation Resources	Health Services (VS)	Military Training Transfer Credits (0.50)
Comprehensive Academic Supports	Job Search/Placement Support	Stigma (0.47)
STEM Job Fairs	VA Services	Clear Academic Path For Veterans (0.46)

Sample FCM Map. To depict the map of all 55 concepts and their connections does not come across as meaningful. However, individual maps as well as maps of each of the eight cluster categories are very meaningful. Figure 2, below, shows an individual map. The size of the shape corresponds with the strength of the relationships between shapes and how many connections it has to other shapes. The number on each line corresponds to the original weighting the participant gave the connection, such that -0.75 = --- and 0.75 = +++.

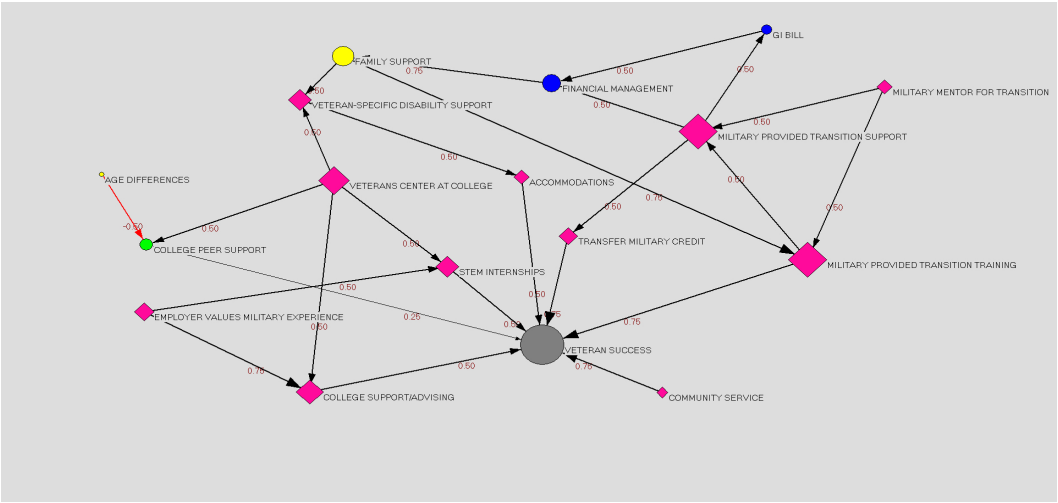
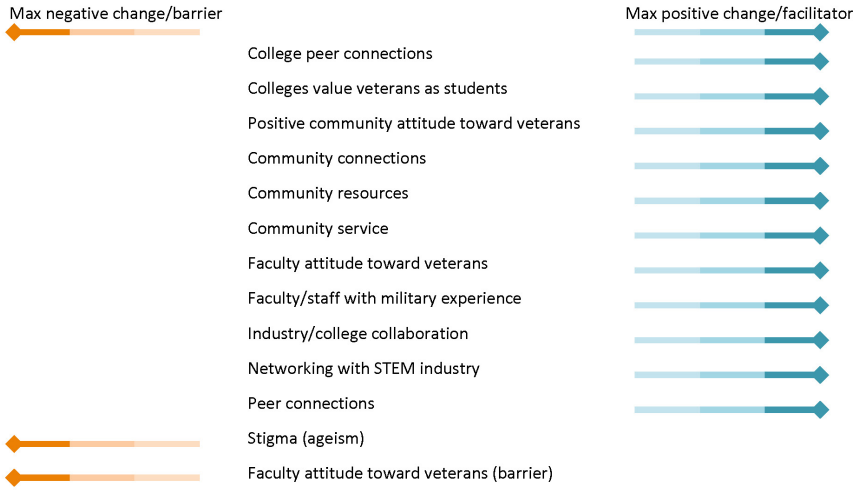


Fig. 2. Sample FCM Map

Scenarios. One of the strengths of model-building is the capability to run scenarios. To see the model at work, researchers used FCMapper, a macro-enabled Excel spreadsheet, which runs squashing functions to test scenarios. Researchers tested scenarios based on a total of eight different existing policy recommendations. To demonstrate the scenario process, *Executive Order: Establishing Principles of Excellence for Educational Institutions Serving Service Members, Veterans, Spouses, and Other Family Members* was selected (The White House 2012). The results emphasized a holistic view of student veterans and the impact of policies and services on their lives as well their STEM career aspirations.

Researchers ran the scenarios with the following eight factors activated at 1.0: (1) academic advisor (veteran specific); (2) flexibility in courses/academic accommodations; (3) assistance navigating resources; (4) services for students with disabilities; (5) education benefits advising; (6) education funding (veteran specific); (7) funding options (non-military); and (8) financial aid stability. Researchers activated unauthentic education opportunities at -1. There were sections of the executive order for which there were not corresponding factors because at this stage, the model only included veterans and transitioning service-members. For example, "obtain the approval of the institution's accrediting agency for new course or program offerings," and "agree to an institutional refund policy that is aligned with the refund of unearned student aid rules" did not have corresponding factors. The model showed that 45 of the 55 (82%) factors identified by participants as leading to veteran success changed; of the 43 factors positively affected, 15 had a maximum positive change. There were two negative changes that were present on most veterans' maps: The scenario run did not reduce the barriers of (1) stigma and (2) faculty attitudes. Table 4 below shows the top factors that had strong positive change and facilitated veteran success and the factors with the strongest negative change that were barriers for veteran success.

Table 4. Executive Order Scenario



Researchers ran similar scenario testing on seven different sets of recommendations pertaining to transition from the military. Across all scenarios the following observations were made:

- Concepts from the personal/community cluster emerged strongly in all of the scenarios. The issues of transitioning from military to civilian life are important and often urgent for veterans. Even when concepts from this cluster are not activated (not mentioned in the sets of recommendations), the application of the full array of other services and supports has an effect on personal factors.
- Activating more concepts did not necessarily equate to higher impact across more factors.
- When concepts pertained to ongoing services like mentoring, as opposed to one-time events results showed more impact on veteran's success. Single events, such as a job fair, or an orientation course, showed lower impact than ongoing systems or services such as centralized college resources and college peer connections.

Discussion

The purpose of this study was to explore and identify both veteran-specific and context-specific factors having an impact on veterans successfully completing their education in preparation

for a STEM career. To do this, the research team used fuzzy cognitive mapping methodology (FCM). FCM was well suited for learning more about the critical factors reported by veterans with invisible disabilities influencing their decisions to enroll and persist in STEM postsecondary undergraduate programs. With this methodology, the researchers were able to gather and describe the factors as perceived by veterans. There is much to be learned from student veterans and transitioning service members–the experts who participated in the Veterans in STEM study. During the mapping exercise, participants had the option to include on their maps things that they did not have access to but that would be beneficial, or to express not having access to something as a barrier. All of the participants chose to include things that would be beneficial in their model, even if they did not have access to them. A majority of the participants wanted to depict models of veteran success that would be constructive and help colleges and universities with decision-making. The first part of the discussion section focuses on the concepts with the most centrality in each of the concept clusters and ideas from the veterans and transitioning service members for what leads to veteran success. The concept cluster is bold and italicized and the concepts are underlined. The paragraphs are grouped by concept cluster, so the concepts featured are part of the concept cluster.

Personal/Community. One of the concepts with the most centrality that appeared on every participant map were *personal factors*. These included needing access to childcare, health care, affordable housing, and transportation. Student veterans also included on their maps that *assistance navigating resources* and supports available for veterans would be helpful. Both student veterans and transitioning service-members expressed that their greatest support for transitioning from the military and going to college either was, or would be, their families and friends (*personal/family resources*).

Transition. Veterans often leave the military with an expectation that because their military service is valued, finding a job will be easy and assistance with navigating benefits and resources is

ready and waiting for them (American Council on Education, 2010). Many veterans are likely to discover finding a job can be difficult and often necessitates getting a college degree or certificate in order to launch a new career (American Council on Education, 2010). Additionally, financial benefits, resources, and other supports are often difficult to navigate and coordinate (American Council on Education, 2010; Burnett & Segoria, 2009; U. S. Department of Labor, 2010; Madaus, Miller, & Vance, 2009; Vance & Miller, 2009). Given this knowledge, it is no surprise that every participant included *military provided transition training* on their maps as a starting place. The participants still in the military were interviewed during their military provided transition training course, either before the class began, during lunch break, or at the end of the day. They were more positive about the experience than the veterans in college, many of whom discovered that TAPS or Transition GPS could have had more information about the transition to postsecondary education. One of the barriers that was most important to service-members and student veterans was the transfer of their military training to civilian credentials and/or college credits (*military training transfer credits*). A common practice was that veterans' military training would amount for only two to four hours of physical education. A thorough transfer credit evaluation was lacking for nearly every student veteran who often expressed concern over completing their degree in the allotted 36 months of the GI Bill.

Navigating college. The Rand Corporation conducted a 2011 study that found that 42% of returning veterans lacked a clear understanding of the benefits available to them and 27% did not know how to get answers to their questions about available benefits (Steele, Salcedo, & Coley, 2011). In addition, only about half of eligible veterans access comprehensive health care through the VA; top barriers to seeking treatment include concerns that it would have an adverse effect on their military or civilian careers (Banal & Maxwell, 2011). On their cognitive maps, participants expressed that having *centralized college resources* would be integral to their (i.e., veteran) success. This could be a

veterans center, but more critical are the faculty, staff, and administrators who help student veterans navigate college. Participants discussed the importance of having a *clear academic path for veterans and servicemembers* with an advisor who is knowledgeable about the GI Bill. Many participants discussed having an orientation or class sections of first year seminars specifically for veterans (*college orientation course (VS), course sections for veterans)*.

University services. From the student veteran perspective, the services most crucial to their success were *comprehensive academic supports*; *learning supports specifically for veterans*; and *services for students with disabilities*. Unlike students with disabilities who have graduated from secondary education with IEPs and transition plans, veterans who have acquired disabilities such as TBI or PTSD may not even know they have a disability until it first surfaces after starting classes. Further complicating the situation, veterans may be reluctant to disclose a disability or seek *accommodations* for the array of learning, memory, sensory, or communication challenges that can be associated with these conditions. One of the challenges expressed with interfacing with disability offices was that the offices typically required a disability rating and documentation from the VA. For veterans who have incurred a service-connected disability, the VA process can take a long time, which holds up academic accommodations that student veterans need to persist in their studies.

Attitudes toward veterans. Veterans expressed that *faculty/staff with military experience* were particularly helpful to them in making the transition from being in the military to being a college student. What was difficult for the student veterans was finding and connecting with the faculty/staff with military experience, especially if the college lacked centralized resources for veterans. Dealing with *stigma* surfaced as a barrier in every veterans' maps, and typically stigma arose from both other students and faculty members. All participants depicted in their maps that stigma is a barrier to

veteran success; the few participants who felt their *college or university valued* veterans as students depicted that value as instrumental to veteran success.

Connecting. For student veterans the most important connections were with their college peers who had a military connection (*college peer connections (VS)* and had a level of military cultural competence. If they had access to a student veteran organization, they were engaged and thought it helped them feel part of campus. Some student veterans participated in *peer mentoring* focused on the college transition and felt those resources were important to success. In their lives as college students, student veterans were immersed in college connections and were going to college in communities that different from where they had grown up. Because of this a few participants discussed opportunities to learn more about their communities as something that would be nice (*community peer connections*).

Finances. Participants expressed concern over finances on their maps and during their interviews. Every student veteran and most transitioning service-members included veteran-specific *education funding*, such as the Post 9/11 GI Bill. Student veterans and service-members who had access to *education benefits counseling* felt it was important to their success, whether the advising came from the VA, the college or university, or a community-based nonprofit.

STEM Industry. This study was focused on student veterans and transitioning military service-members who were interested in a career in science, technology, engineering, or mathematics (STEM). Most participants identified *job search support* and *internships* as one of the most important things higher education could do to support STEM students, whether they are veterans or not. However, student veterans expressed concern over ageism with employers wanting to connect with traditional-aged students. Student veterans also noted that they were no longer at a place in their adult lives where they could take advantage of an unpaid internship. A few participants expressed a

need for some sort of *STEM career orientation* at their college or university that included an opportunity to connect with industry representatives.

The model incorporated the experiences and insights of 69 veterans and service members pertaining to college-going. Based on the concepts with the most centrality, as well as running scenarios on the model, a few implications for college-level supports and instruction emerged. Some of the most potentially positive policies and practices that higher education institutions can implement to support veterans follow:

- One opportunity colleges and universities have to transform their institution initially for student veterans, and ultimately for all students, is to become more trauma-informed in teaching and learning environments.
- Every single veteran identified stigma as a barrier, from both faculty and students. Implementing At Ease Zone training, or something similar, might help reduce the stigma student veterans face. Related to this, having a way for student veterans to connect with faculty/staff with military experience would be a helpful source of support. Additionally, efforts that indicate the institution values veterans as students are important to reducing stigma.
- In both policy and practice institutions of higher education need to recognize that veterans and servicemembers are nontraditional students and the personal factors such as access to childcare, health care, affordable housing, and transportation are critical. If there are veteran supports, such as a veteran's center, the immediate family members of veterans should also be welcome and have access to resources offered.
- A review of the process for evaluating military training transfer credits beyond physical education credit would provide a significant support to student veterans. Even if there is not

credit that would transfer, the veterans would like to know that their transcripts were evaluated individually rather than subject to a blanket policy.

- Make available centralized college resources for veterans and for their immediate family members who might be using their GI Bill. This does not necessarily need to be a veteran's center. Ultimately students with previous military affiliation require a centralized location and/or expert where they can receive assistance with navigating resources from someone who understands the complexities of the resources–both those available at the college or university and those available through the VA.
- Make available accommodations before the official service-connected disability rating, even with the understanding that it will be adjusted once the rating is made.

The problems of veterans and service-members going to college is situated in factors that occur at several different levels of postsecondary education–from personal decisions to use a resource or be engaged–to institutional policies and resource allocation. Whether an institution is already implementing the above list of promising practices supported by the data, or just underway it is important to keep in mind that student veterans are not seeking handouts or shortcuts. Through their service they have earned benefits such as the GI Bill, and just like any other student, they deserve any support a college or university makes available.

Limitations. Veterans in STEM has methodological and researcher limitations. While research exists, there is a lack of prior research studies using any sort of collaborative modeling technique, such as FCM, focused on student veterans. The data in Veterans in STEM is self-reported data. Since many of the participants experienced PTSD, they may also have explicit memory biases for threat, resulting in the recall of more negative situations than positive.

While the study did not focus on experiences during their time in service, it did focus on transition and often touched upon the Veterans Administration. Several study participants experienced PTSD and may have repetitive memories of their trauma. Researchers suggest biased memory processes in PTSD (Coles, 2002). Because Veterans in STEM data collection occurred over eight months, and each interview took between 60 and 90 minutes, the researchers became much more experienced with the methodology and the veteran and service-member population as the study progressed. Lastly, the researchers are not military veterans, and do not share the experiences of student veterans. The limitations of the FCM method pertaining to this study are related to aggregation and good measures for similarity. When combining all participant maps into the model, one of the steps is to average the weights in the adjacency matrix. This leads to tiny weights in the model and so when examining the data it can be easy to interpret a small effect due to the averaging of the weights. This still needs to be addressed in FCM. Additionally, as a methodology, determining how to measure similarity troubles FCM. Because the cognitive maps are causal and represent one person's perspective and thought process, and because people are individual thinkers, no two maps are similar. This makes reaching saturation difficult to gauge. Despite the challenges with FCM, there is still value for its use as a methodology.

The model to-date has demonstrated that FCM is an effective methodology for capturing the experiences and perspectives of student veterans and transitioning service-members. The model is ready for simulating potential policy changes and showing predicted outcomes for student veterans. Next steps for the Veterans in STEM study are to expand the model by adding in cognitive maps from higher education faculty/staff/administration, community veterans' resources, and employers. Additionally, the model would benefit from more female veteran participants.

Conclusion

The issues and challenges faced by post 9/11 veterans transitioning from military life, seeking a college degree, and finding a career are not universally recognized and addressed. Navigating postsecondary education is an important piece to this puzzle. Veterans often return from deployment with knowledge of sophisticated technology and valuable process management and field-based experiences that are relevant and valuable to many industries. The military has invested monetary resources in service-member training and veterans' field-based accomplishments should provide a smooth transition into degree programs and civilian careers. However, veterans and postsecondary education do not uniformly understand how and when to connect military experiences with future careers (Jenson & Petri, 2011; US Department of Labor, 2010). With GI Bill benefits available and being used by veterans, when veterans do enroll in postsecondary education, they need to have supports available to accomplish their academic goals and transition to careers.

Models are simplified versions of a complex situation that help us communicate with multiple stakeholders and make evidence-based decisions. FCM offers a method of "dealing with situations where the data at hand is insufficient for a full quantitative description, uncertainty is high…and a range of non-quantifiable elements are important" (Wildenburg, Bachhofer, Adamescu, DeBlust, Diaz-Delgadod, Isak, Skov, & Riku, 2010, p. 2). The Veterans in STEM study provides first-of-its-kind data about what student veterans need to complete their degrees and build careers beyond the military.

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Notes

[1] While the research questions uses the term "critical factors," the paper uses the term concept throughout because that is the term used in fuzzy cognitive mapping. The original research question was modified for this paper to include "(or concepts)" for clarity.