Social Responsibility and Veteran Student Retention in Engineering

Mr. Jeffrey Chase Hood MA, Kansas State University

J. Chase Hood is a doctoral student in the Department of Psychological Sciences at Kansas State University. He studies cognitive psychology, experimental design, statistical analyses, and seeks to apply his research to improving education.

Dr. Stacey Elizabeth Kulesza P.E., Kansas State University

Dr. Stacey Tucker-Kulesza is an assistant professor in the civil engineering department at Kansas State University. Dr. Tucker-Kulesza teaches undergraduate and graduate courses in geotechnical engineering and is a licensed engineer in the state of Kansas.

Dr. Jia G. Liang, Kansas State University

Jia Grace Liang is a faculty in the Department of Educational Leadership at Kansas State University (USA). Her research interests focus on school leadership, professional development and learning in STEM, equity for women and racial minorities, and leadership for community engagement. She holds a PhD from the University of Georgia in Educational Administration and Policy.

Dr. Eric J. Fitzsimmons, Kansas State University

Dr. Eric Fitzsimmons, P.E. is an assistant professor in the civil engineering department at Kansas State University. He received his B.S., M.S., and Ph.D. degrees in Civil Engineering with a specialization in transportation from Iowa State University. Dr. Fitzsimmons is a graduate of the American Society of Civil Engineers Excellence in Civil Engineering Education (ExCEED) and also has served as an assistant mentor. He teaches undergraduate and graduate courses in transportation and railroad engineering.

Dr. Jeff Zacharakis, Kansas State University

Jeff Zacharakis is a professor of adult learning and leadership in the Department of Educational Leadership. His areas of research include leader and organizational development.

©American Society for Engineering Education, 2019

Investigating the Role of Social Responsibility on Veteran Student Retention in Engineering

Abstract

Despite considerable gains made towards increasing students' interest in STEM education, one specific population, Veterans in engineering, suffers from disproportionally high attrition. Social responsibility is a motivating factor for becoming an engineer and has been identified as a successful intervention strategy to improve retention of first-year engineering students. Social responsibility is also a core value instilled by all branches of the U.S. military while actively serving. Therefore, the objective of this research study was to examine Veterans' perceptions of social responsibility related to engineering. For this study, a survey instrument was designed, piloted, revised, and launched for instrument validation and exploratory examination of the relationship between social responsibility and Veteran students' core beliefs. Results of this study showed that both Veteran and first-year non-Veteran engineering students strongly value the tenants of social responsibility. The results of this study indicate the potential for curriculum and policy changes to increase Veteran retention in engineering programs.

Introduction

The National Science Foundation [1] indicated that approximately 6.1% of students in the US select engineering as a field of study. An important aspect for engineering programs across the country is to retain these students. In 2007 it was found that the retention rate continues to steadily increase from 70 years ago from 28% to 56% in 2007 [2]. This increase in retention is likely due to advances in knowledge and practices within engineering education. However, this increase in retention has not extended equally to historically underrepresented populations. While many students that enter an engineering program can be described as underrepresented (e.g., women, African American, and Hispanic), research is still needed that focuses specifically on Veteran students.

A review of previous literature focusing on Veteran student retention indicated these students find it difficult to connect with their oftentimes younger peers [3], [4]. Additionally, Radford [5] defined a Veteran's military service as an identifiable difference from traditional students who are under the age of 24 and fiscally dependent on their parents. Therefore, most of the literature that focused on engineering student retention is potentially not applicable to Veteran students. Furthermore, Veteran students entering higher education have been found to view the college experience as a means of forming identity self-perceptions [6]. This idea of social isolation coupled with the traditional "survival of the fittest" model present in many engineering programs may fail to provide a learning environment in which students in general, including Veteran students, feel sufficiently motivated to remain in an engineering program [7]. This is further emphasized by the fact that, at the authors' institution, attrition is disproportionately high in Veteran engineering students as compared to their peers [8].

A preliminary analysis of Veteran retention in the college of engineering program was conducted in the fall semester of 2015 at Kansas State University (K-State), a four-year land grant institution [8]. Retention in this context is defined as a student successfully graduating from the college of engineering regardless of the time required to complete the program. Data extracted included students who self-identified as a Veteran when they entered the college of engineering. As shown in Fig. 1, colors and gender symbols indicate the percentage of students who graduated, were in progress with their engineering degree, changed majors, and students who were dismissed or discontinued enrollment. The analysis showed that approximately 8.9% of Veterans graduated from the college of engineering while over 50% were dismissed or discontinued enrollment. Additionally, approximately 34% of the discontinued/dismissed students left after their first semester and another 31% left after their first year. These results indicate the importance of the students' first year and whether they continue not only in their engineering major, but in the college of engineering. The preliminary study concluded that the rate of attrition at K-State was approximately twice that of non-Veteran engineering students during the time period. This is considerably lower than graduation rates of non-traditional students nationwide, which are 64% for full-time non-traditional transfer students and 58% for full-time non-traditional students entering college for the first time. In fact, non-traditional students tend to have a higher graduation rate compared to traditional students, whose graduation rates for full-time students are 59% and 49% for transfer and first time in college, respectively [9].

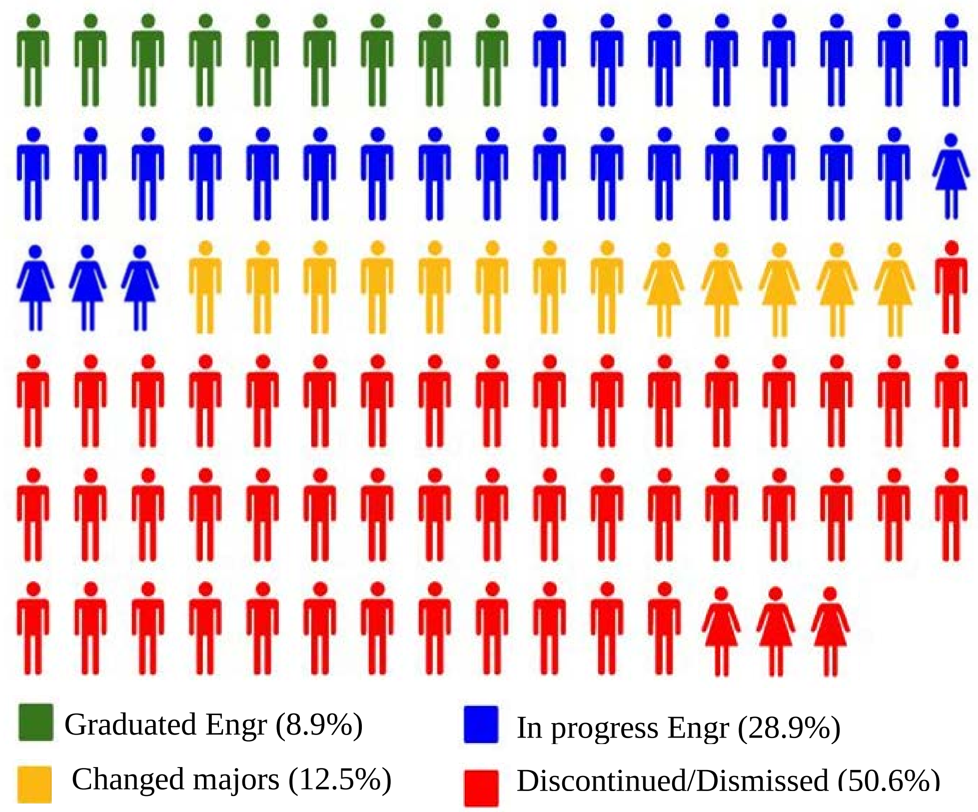

Fig. 1. Matriculation of Veteran students who entered the K-State College of Engineering from 2008-2015

This research seeks to address the discrepancy in retention between Veteran and non-Veteran students in engineering. Specifically, this research examined the perceptions of social responsibility in Veteran and non-Veteran students to determine if these perceptions could be used to enhance Veteran retention in engineering. Social responsibility is embodied in the *Engineer's Creed* and is directly related to engineering ethics [10], so much so that the engineering accrediting agency ABET requires that graduates can approach their work in a socially responsible manner [11]. The principles of social responsibility are what attract many students to engineering, specifically those from underrepresented groups [12]. Matusovich et al. [13] and Mehaffy [14] identified the need to incorporate students' personal values, such as social responsibility, into the engineering curriculum to allow them to personally connect with their engineering identity and thereby increase retention. The principles of social responsibility (e.g., to consider the needs of society above themselves in their work) are also widely stressed in the military. Strong convictions in social responsibility have been shown to increase retention in engineering students [15] – [17] but there has been limited research linking social responsibility and Veteran students' retention. Thus, the primary objective of this research was to address this limitation by empirically examining the core values common to both first-year non-veteran and Veteran engineering students

A survey that was continuously refined based on input from an external advisory board of experts and focus groups with Veteran and non-Veteran first-year engineering students was used in this multi-stage study. The present research focuses on incorporating data from multiple sources at multiple time points with the goal of designing a survey instrument that allows a comprehensive and psychometrically sound examination of Veteran and non-Veteran first-year students' perceptions of social responsibility. Information regarding data collection and survey refinement are described herein, along with results, conclusions, and future work.

Theoretical framework – social responsibility

The research team used The Professional Social Responsibility Development Model (PSRDM) [18] as the framework for the study survey instrument. The PSRDM, instead of offering a novel conceptualization of social responsibility, integrates various existing models of social responsibility development into a more cohesive and complete model. Specifically, this allows for a model that treats social responsibility development as a continuum rather than a static state. The PSRDM is comprised of three realms of social responsibility: Personal Social Awareness, Professional Development, and Professional Connectedness as summarized in Table 1. The Personal Social Awareness realm focuses on an individual's duty to act selflessly for the good of others, or society as a whole. The Professional Development realm focuses on an individual's recognition and motivation to increase one's skills and capacities in order to apply these for the good of others. The Professional Connectedness realm describes how one's moral obligation to help others exists as a part of one's professional identity, in this case as a Veteran or an engineer, and how engagement in services to others strengthens this obligation. Column four in Table 1 lists the number of items representing each dimension of social responsibility used in this study. The number of items representing each realm is the sum of the items used to represent each of the dimensions comprising it.

Table 1: Dimensions of the PSRDM reproduced from [18]

Realm	**Dimension**	**Definition**	**Number of Items Used in this Study**
Personal social awareness	Awareness	An awareness that others are in need.	2
	Ability	A recognition that one has the ability to help others.	2
	Connectedness	A felling of moral obligation, responsibility, or social requirement to help others.	2
Professional development	Base skills	With an expectation that all engineers value the technical skills, this dimension focuses on views of professional skills (e.g., communication, lifelong learning, teamwork, management, ethics, or professional responsibility) and the role that they play for a professional engineer.	16
	Professional ability	A recognition that engineers or the engineering profession has the ability to help others and/or solve social issues.	3
	Analyze	A recognition of the importance of including social aspects in the engineering process, including community feedback, and a broad sense of stakeholders.	4
Professional connectedness	Professional connectedness	Addresses issues of responsibility or obligation that an engineer or the engineering profession may have to help solve social problems or help others through their professional capacity.	4
	Costs-benefits	Discussion of the costs and benefits associated with engaging in socially responsible behavior, such as service.	0

Study design and process

The research was executed in three phases: instrument design (Phase I), validation (Phase II), and full survey launch and data analysis stage (Phase III). Phases I and II focused on tailoring the research instrument to be appropriate for both the research objectives and populations of interest. Phase III focused on answering the research question and laying the groundwork for future research. The phases for this research project are described herein.

Pilot phase I: Survey development

A survey to identify social responsibility based on the PSRDM was developed using the Dillman Tailored Design method [19], specifically geared towards Veteran students. A formerly validated survey, the Engineering Professional Responsibility Assessment (EPRA) [18], was selected as the initial survey. This survey was selected because it targets students in their first year, an extremely important period concerning Veteran student retention. The EPRA is a 65-item measure of social responsibility that conceptualizes social responsibility into eight distinct but related constructs (see Table 1). The EPRA contains Likert-type items that range from 1 (Strongly Disagree) to 7 (Strongly Agree) which was shortened to 1-5 Likert scale for this study. Examples of items from the EPRA include, “It is important to me personally to have a career that involves helping people”, and “I feel an obligation to contribute to society.” In Phase I, questions that did not fit the project research objectives were removed. Other questions were removed to reduce redundancy and questions involving the “Costs-Benefits” dimension were removed as these were less relevant to the research question. Specifically, the Cost-Benefit dimension focused on an individual’s willingness to sacrifice financial gain in order to help society. This monetary aspect of the EPRA was outside of the scope of the current research question and as such the authors decided to not include these items in the survey. This decision was later supported by an advisory board (described below) agreeing that these items were beyond the scope of the research question and that the survey should be as concise as possible. Military specific demographic questions such as years of military service and military branch were added. Four new questions specifically linking social responsibility and military service were also added. These four questions were: 1. “I cannot see the connection between my service in the military and the profession of engineering”; 2. “The profession of engineering provides a pathway for continuing my wanting to serve, be it communities locally, nationally, and globally”; 3. “I am pursuing a degree in engineering because it is a profession similar to what I have done in the military”; and 4. “I enrolled in the engineering program because I have the opportunity to help people”. The survey was identical for both Veterans and first-year students except that only the Veterans received the military-specific questions.

An external advisory board was also created to review the survey instrument prior to piloting. The external advisory board was comprised of seven Veterans at the university, including university administrators, engineering faculty, a graduate student, and an undergraduate student. The advisory board covers a range of demographics, military ranks, and academic and professional connections with engineering. The advisory board reviewed the modified pilot survey individually and then met as a group for further discussions to ensure the questions were phrased in a meaningful way. The pilot survey was modified again based on the input from the advisory board including rephrasing some items for clarity as well as shortening the total number of items from 65 to 24. Removal of questions was based on perceived redundancy.

Pilot phase II: Small scale piloting and survey refinement

The pilot survey was sent to students randomly selected from two lists of Veteran and non-Veteran engineering students at a four-year land-grant institution. Pilot data were collected from 11 Veteran and 16 non-Veteran first-year students. It should be noted that a sample of this size would not be adequate to make any confident conclusions regarding the primary research questions address in Phase III. As such, inferential statistics were not performed on this sample. However, a small pilot sample such as this one provided valuable insights into the appropriateness of the assessment instrument and allowed them to make changes before the data collection proper occurred. This was further supported by qualitative feedback solicited during the focus groups sessions. The participants of the pilot survey were given the opportunity to volunteer to participate in follow-up focus groups by providing their email address. After piloting the survey, focus groups with students (five Veteran, one non-Veteran) who volunteered in the pilot survey were conducted to solicit survey feedback. These participants were asked to provide their opinions on the appropriateness of the questions, both in terms of wording as well as content. An example modification made from this information was the removal of the term “MOS” (military occupational specialty) from a question asking about previous military assignments. The term “MOS” is army-specific and was offensive to Veterans from other branches of the military. Additionally, the Veteran students strongly warned against asking for specific service details, especially involving combat, as doing so could act as a trigger for some Veterans. All students received monetary compensation for their time for both the pilot survey and focus group participation.

Phase III: Full launch and data analysis

The revised survey was launched to all Veteran students and first-year engineering students in Fall 2018 and analyzed. The fall semester was selected for survey deployment based on the preliminary analyses of Veteran retention (recall that 65% of Veteran students left the engineering program by the end of their first year). The survey invitations were sent to all self-identified Veteran engineering students and all non-Veteran first-year students. The choice to invite all self-identified Veteran students regardless of degree progression was due to the small Veteran population currently in the college of engineering. First-year non-Veteran students were also invited to provide the sample size needed for survey validation and for comparison to the Veteran students. Veteran students who participated in this phase of the study were compensated with a $20 gift card. Non-Veteran first-year students were compensated with $5 in university credit that they could spend on food or supplies on campus. The choice to compensate the Veteran students more than the non-Veteran first-year students was to account for the much smaller Veteran student population size compared to non-Veteran first years.

Ultimately, 22 (approximately 52%) Veteran students and 412 (approximately 45%) non-Veteran first-year students completed the survey. Results of the survey found that 74% of respondents identified as male, 23% as female, 1% as other, and 1% no response. As expected, Veteran students (M = 27.81, SD = 5.37) were significantly older on average than were first-year students (M = 18.37, SD = 0.97), $t(423) = 28.07$, $p < .001$, where M = mean, SD = standard deviation, t(###) = the independent sample t-test statistic with degrees of freedom in parentheses, p = probability of committing a type-1 error where a value below .05 is considered statistically significant. This was expected as Veteran students enter higher education on average considerably later than do non-Veteran students and because only first-year non-Veteran students were sampled for this study. Table 2 displays the distribution of demographic variables for Veterans and first-years. Table 3 shows Veteran specific questions regarding their military service. Note that “Missing” indicates that the student did not respond to the question. Students were free to skip any question without penalty.

Table 2: Distribution of demographics for Veteran and first-year students

Categories		**Veterans**	**First-years**	**Total**
Gender	Female	2	99	101
	Male	19	304	323
	Other	0	4	4
	Missing	1	5	6
Major	Architectural Engineering and Construction Science	3	29	32
	Biological and Agricultural Engineering	2	10	12
	Chemical Engineering	0	35	35
	Civil Engineering	0	19	19
	Computer Science	8	64	72
	Electrical and Computer Engineering	3	51	54
	Industrial and Manufacturing Systems Engineering	1	21	22
	Mechanical and Nuclear Engineering	4	109	113
	Undecided at this Time	0	39	39
	Open-option	1	30	31
	Missing	0	5	5
Race and Ethnicity	Asian	1	37	38
	Black or African American	0	15	15
	Hispanic or Latino	3	37	40
	Indigenous Peoples	0	8	8
	Native Hawaiian or Pacific Islander	0	6	6
	White	20	351	371
	Other	1	11	12
	Prefer not to answer	1	10	11
Employment	Full-time	1	6	7
	Part-time	7	95	102
	Unemployed	14	306	320
	Missing	0	5	5
Marital Status	Currently married or engaged	9	9	18
	Not currently married or engaged	12	398	410
	Missing	1	5	6
Parental Status	Is a parent	3	2	5
	Is not a parent	18	405	423
	Missing	1	5	6
Family Members in Engineering	Yes	5	216	221
	No	17	191	208
	Missing	0	5	5
Work Experience in Engineering	Yes	9	128	137
	No	13	289	302
	Missing	0	5	5

Table 3: Veteran student military service attributes

Categories		**Veterans**
Time Served in Active Duty	Less than five years	13
	Five to ten years	8
	More than ten years	1
Time Served in Reserves	Less than five years	11
	Five to ten years	3
	Did not serve in Reserves	8
Deployment Status	Was deployed.	15
	Was not deployed	7
Military Branch	Air Force	4
	Army	10
	Marines	4
	Navy	2
	Missing	2

These data were then analyzed to assess the psychometric properties of the survey and to compare levels of social responsibility between Veteran and first-year engineering students. To accomplish this, the average levels of social responsibility were compared between Veteran and first-year students using an independent samples *t*-test. Additionally, a series of correlation analyses were performed to investigate the effects of different predictors (e.g., demographics) on social responsibility and whether these effects varied as a function of military service. To further investigate how Veterans and first-year students perceive social responsibility beyond average social responsibility levels, a series of confirmatory factor analyses were preformed to attempt to replicate the factor structure of social responsibility found in previous research.

Results and Discussion

The modified EPRA demonstrated good psychometric properties (e.g., internal consistency). For the items (i.e., survey questions) that all participants answered, Cronbach's $\alpha = .87$, above the .80 threshold typically considered to represent good internal consistency [20]. Additionally, the average social responsibility score across all participants was 4.00 ($SD = 0.35$). This indicated high levels of social responsibility across all engineering students. The data also replicated the factor structure found in previous research [16]. This was demonstrated by testing the goodness of fit of three different confirmatory factor models: a null, single-factor model; a three-factor superordinate model; and a subordinate seven-factor model. The three-factor model corresponds to the "Realms" in Table 1 while seven-factor model corresponds to the "Dimensions" in Table 1, with the exception of the "Costs-Benefits" dimension. Both the three- and seven-factor models fit better than the single-factor model as shown in Table 4.

Table 4: Goodness of Fit Statistics for the social responsibility Factor Analyses.

Model	CFI	TLI	RMSEA	AIC
Single-Factor	.54	.51	.09	32,230
Three-Factor	.64	.62	.08	31,820
Seven-Factor	.80	.77	.06	31,254

Note: CFI = Comparative Fit Index; TLI = Tucker-Lewis Index; RMSEA = Root Mean Square Error of Approximation; AIC = Akaike Information Criterion.

Unlike other common statistical tests, factor analytic techniques do not normally use traditional significance testing to compare model fit. Rather, model fit is compared by examining a number of parameters, each with various strengths and weaknesses. Higher CFI and TLI values are preferred, with values above .80 suggesting a generally good model fit. Lower RMSEA values are preferred, with values lower than .08 suggesting adequate model fit and below .06 suggesting good model fit. The AIC is scale-invariant, meaning the absolute values are not important. Rather, the model with the lowest relative AIC value is the most supported. Generally, a difference of 10 AIC units is considered strong evidence in favor of the model with the lower AIC. Comparing the three-factor and seven-factor models in Table 4, the seven-factor model's AIC is 565.19 lower than the three-factor model's, indicating that the fit of the seven-factor model is superior to that of the three-factor model. The seven-factor subordinate model, a more precisely delineated variant of the superordinate three-factor model, provided the best fit of the three models based on all of the model fit criteria discussed above. This suggests that the increased model complexity provides additional, meaningful information above and beyond the simpler three-factor model.

In terms of demographic variables, gender was the only variable shown to affect social responsibility in this sample, with females (M = 4.09, SD = 0.38) scoring slightly higher on social responsibility than males (M = 3.96, SD = 0.41), $t(422) = 2.54$, $p = .011$. Participants who did not identify as either male or female were not included in this analysis. Other demographic variables such as Veteran status, parental education, having a family member who is an engineer, engineering major, and being previously employed as an engineer had no effect on social responsibility ($p > .05$) and thus hierarchical regression models were not analyzed to probe these relationships further. The fact that social responsibility did not differ by major is somewhat inconsistent with other research, though this may be an artifact of including ten different student engineering groups (i.e., majors) in the one-way analysis of variance (see Table 2 for a list of majors included in the analysis). Due to insufficient amounts of data, it was not possible to compare the effects of these demographic variables across Veteran and non-Veteran students though this would be useful to examine in future work with a larger sample size.

Based on these data, there was no overall difference between the average social responsibility scores of Veteran (M = 3.83, SD = 0.41) and non-Veteran first-year (M = 3.99, SD = 0.41) engineering students, $t(432) = 1.76$, $p = .079$. To examine this more closely, the social responsibility of Veteran and non-Veteran students was compared across the seven dimensions of social responsibility. The only dimension on which Veteran and non-Veteran students significantly differed was Ability (i.e., recognition that one has the ability to help others) with Veterans (M = 3.59, SD = 0.68) showing slightly lower scores in the Ability dimension compared to non-Veterans (M = 3.95, SD = 0.62), $t(431) = 2.65$, $p = .008$. Because of the relatively small number of female Veteran students (*n* = 2), the same analyses were run again only with male students. The pattern of results were nearly identical, with the only significant difference in social responsibility being in the Ability dimension with male Veteran students (*M* = 3.58, *SD* = 0.73) showing slightly lower scores in Ability compared to male non-Veteran students (*M* = 3.95, 0.61), $t(321) = 2.58$, $p = .010$ (all other *p*s > .05). In both of these instances, social responsibility between Veteran and non-Veteran students differed only in one of the seven dimensions, this difference was small, and both groups scored high on this dimension overall.

As shown in Table 5, Veteran students exhibited considerable variability when comparing their military service and engineering and their motivation to pursue an engineering degree. For all items, some Veterans endorsed the statement positively, some negatively, and some neutrally, suggesting there is not a general consensus among these Veterans concerning these issues.

Table 5: Descriptive statistics of Veteran-specific questions.

Question	**Mean**	**Standard dev.**	**Min**	**Max**
I cannot see the connection between my service in the military and the profession of engineering.*	3.32	1.32	1	5
The profession of engineering provides a pathway for continuing my wanting to serve, be it communities locally, nationally, and globally.	3.59	1.01	2	5
I am pursuing a degree in engineering because it is a profession similar to what I have done in the military.	2.23	1.19	1	4
I enrolled in the engineering program because I have the opportunity to help people.	3.09	0.87	1	5

*Note: * indicates a reverse-coded item.*

Limitations

One limitation of this study is the relatively small sample size of Veteran students. Approximately 50% of the Veteran students enrolled in the college of engineering were recruited to participate in this study, however, the unforeseeable decrease of the newly admitted Veteran engineering students reduced the size of the population from which the sample could be drawn. The second limitation related to the unequal representation of majors and genders, particularly for Veteran students as shown in Table 2. As such, the degree to which the data might be examined is limited. For example, it was believed that, relative to other majors, civil engineering students tend to demonstrate higher social responsibility; the current data did not allow such across-major examination as no Civil Engineering Veteran students participated. Nevertheless, the gender and major representation in the sample was a close reflection of the gender and major distribution of the student population in the college of engineering.

Conclusions and Future Work

Despite the considerable improvements in engineering student retention that have been made over past decades, high rates of attrition among Veteran engineering students remain a problem. This research sought to address this problem by filling a gap in the extant literature on the subject; do Veteran students in engineering share the same strong social responsibility values that previous research has demonstrated in engineering students in general? The results of this study suggest the answer is yes, in that that social responsibility may act as a potential avenue for interventions focused on increasing Veteran student retention. The most prominent result of this research was that there was no overall difference between the average social responsibility scores of Veteran and non-Veteran first-year engineering students. This indicates that, despite qualitatively different life experiences, social responsibility is universally high among both Veteran and non-Veteran engineering students in this sample and thus Veteran students are no less sensitive to social responsibility than first-year engineering students. Therefore, this also provided evidence that previous research on the motivating effect of social responsibility on first-year engineering student retention may apply to Veteran students. Additionally, the results of this study replicated previous research that found that women consistently show stronger social responsibility beliefs than men, though both genders exhibited high social responsibility overall.

The next phase of this research will be another focus group discussion with Veterans to identify how they define social responsibility in relation to the PSRDM. Also, participants were also asked to list the names of any instructors that incorporated social responsibility into their classes. These faculty will be consulted to assess how and why they incorporate social responsibility into their curriculum. The final focus group with Veterans and faculty consultations will be used to generate additional ideas for the development of social responsibility-based interventions. It is also important that these results be replicated in future studies. The current researchers intend to collect additional data in the fall semester of 2019 to replicate these results. However, future longitudinal research that tracks students' perceptions of social responsibility over time and retention is necessary. Such longitudinal research would assess student social responsibility attitudes at multiple time points and would relate this to completion of their engineering degree, providing useful information above and beyond what can be provided by a single cross-sectional examination as was done in this study. This research could also examine the effectiveness of interventions on Veteran and non-Veteran student retention, and test the effectiveness of different interventions against one another while also testing if different interventions are more effective for different cohorts (e.g., Veteran students, students in different majors, students with different social responsibility perceptions).

Finally more research is needed to identify and test interventions that increase student retention in engineering, specifically among underrepresented populations such as Veteran students.

Acknowledgements

Funding provided by the National Science Foundation (Award #1738145). Opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the NSF. The authors express their gratitude to all survey participants and members of the advisory board for their role in this research.

References

[1] National Science Foundation. “NSB Science & Engineering Indicators 2016,” [Online]. Available: https://www.nsf.gov/statistics/2016/nsb20161/#/downloads/report.

[2] D. Q. Knight, L. E. Carlson, and J. F. Sullivan. “Improving engineering student retention through hands-on, team based, first-year design projects,” *13th International Conference on Research in Engineering Education, Honolulu, Hawaii*.

[3] D. DiRamio, R. Ackerman and R. L. Mitchell, "From Combat to Campus: Voices of Student-Veterans," *NASPA Journal*, vol. 45*, (1),* pp. 73-102, 2008.

[4] J. L. Steele, N. Salcedo, and J. Corey, “Service members in school”, New York: American Council on Education, 2010.

[5] A. Radford, “Military service members and veterans in higher education: What the new GI bill may mean for postsecondary institutions,” New York: American Council on Education, 2009.

[6] C. B. Rumann and F. A. Hamrick, "Student Veterans in Transition: Re-enrolling after War Zone Deployments," *The Journal of Higher Education*, vol. 81, *(4)*, pp. 431-458, 2010.

[7] E. Kuley, T. Fonstad, and S. Maw, “Engineering Student Retention and Attrition Literature Review,” in *Proceedings of the Canadian Engineering Education Association*, 2015.

[8] S. E. Tucker-Kulesza, G. L. Liang, E. J. Fitzsimmons, and J. Zacharakis, “Work in Progress: Investigating the Role of Social Responsibility on Veteran Student Retention,” *ASEE Annual Conference & Exposition*, Salt Lake City, Utah, 2018.

[9] J. McNeil, M. W. Ohland, and R. A. Long, “Engineering Pathways of Nontraditional Students—an Update on NSF Award 1361058,” *122nd ASEE Annual Conference & Exposition*, Seattle, Washington, 2015.

[10] J. R. Herkert, "Ways of thinking about and teaching ethical problem solving: Microethics and macroethics in engineering," *Sci. Eng. Ethics*, vol. 11, *(3),* pp. 373-385, 2005.

[11] ABET, “Criteria for accrediting engineering programs, 2016-2017”, *Accreditation Board for Engineering and Technology*, ABET. 2017 [Online]. Available: https://www.abet.org/accreditation/accreditation-criteria/criteria-for-accrediting-engineering-programs-2016-2017/

[12] K. Meyers and B. Mertz, "A large scale analysis of first-year engineering student essays on engineering interests," in *ASEE Annual Conference and Exposition*, Washington, D.C., 2011.

[13] H. M. Matusovich, R. A. Streveler and R. L. Miller, "Why Do Students Choose Engineering? A Qualitative, Longitudinal Investigation of Students' Motivational Values," *J Eng Educ*, vol. 99, *(4)*, pp. 289-303, 2010.

[14] G. Mehaffy, "Preparing undergraduates to be citizens: The critical role of the first year of college", in *First-Year Civic Engagement: Sound foundations for College, Citizenship and Democracy*, M. J. LaBare, Ed. New York: The New York Times Knowledge Network, 2010, pp. 5-9.

[15] G. Hein and A. Kemppainen, "First-year engineering students ethical analysis," in *ASEE Annual Conference and Exposition*, Vancouver, 2011.

[16] J. Lo, V. Lohani and J. Mullin, "Introduction of Contemporary Engineering Ethics Issues in a Freshman Engineering Course," in *ASEE Annual Conference and Exposition*, New Orleans, Louisiana, 2016.

[17] M. Vigeant, J. Baish, D. Cavanagh, T. DiStefano, X. Meng, P. Vesilind and R. Ziemaian, "Ethics for first-year engineers: The struggle to build a solid foundation," in *ASEE Annual Conference and Exposition*, Portland, Oregon, 2005.

[18] N. Canney and A. Bielefeldt, "Validity and reliability evidence of the engineering professional responsibility assessment tool," *Journal of Engineering Education*, vol. 105, no. 3, pp. 452-477, 2016.

[19] D. A. Dillman, J. D. Smyth and L. M. Christian, *Internet, Mail, and Mixed-Mode Surveys: The Tailored Design Method*, 4th ed. Hoboken: Wiley 2014.

[20] J. M. Cortina, "What is coefficient alpha? An examination of theory and applications," *J. Appl. Psychol.*, vol. 78, *(1)*, pp. 98-104, 1993.