Social Responsibility Related to Global Experiences and Interests of U.S. Engineering Students

Dr. Angela R. Bielefeldt, University of Colorado, Boulder

Angela Bielefeldt is a professor at the University of Colorado Boulder in the Department of Civil, Environmental, and Architectural Engineering (CEAE). She has served as the Associate Chair for Undergraduate Education in the CEAE Department, as well as the ABET assessment coordinator. Professor Bielefeldt was also the faculty director of the Sustainable By Design Residential Academic Program, a living-learning community where interdisciplinary students learn about and practice sustainability. Bielefeldt is also a licensed P.E. Professor Bielefeldt's research interests in engineering education include service-learning, sustainable engineering, social responsibility, ethics, and diversity.

Dr. Greg Rulifson P.E., Colorado School of Mines

Greg currently teaches in Humanitarian Engineering at CSM. Greg earned his bachelor's degree in Civil Engineering with a minor in Global Poverty and Practice from UC Berkeley where he acquired a passion for using engineering to facilitate developing communities' capacity for success. He earned his master's degree in Structural Engineering and Risk Analysis from Stanford University. His PhD work at CU Boulder focused on how student's connections of social responsibility and engineering change throughout college as well as how engineering service is valued in employment and supported in the workplace.

Dr. Nathan E. Canney, CYS Structural Engineers Inc.

Dr. Canney conducts research focused on engineering education, specifically the development of social responsibility in engineering students. Other areas of interest include ethics, service learning, and sustainability education. Dr. Canney received bachelors degrees in Civil Engineering and Mathematics from Seattle University, a masters in Civil Engineering from Stanford University with an emphasis on structural engineering, and a PhD in Civil Engineering from the University of Colorado Boulder.

Social Responsibility Related to Global Experiences and Interests of U.S. Engineering Students

Abstract: This research explored if and how global interests and experiences relate to engineering students' ideas of professional social responsibility. The mixed-methods study included quantitative information from about 3300 students who completed online surveys and qualitative information from both open-ended questions on the surveys and longitudinal interviews with a small group of engineering students and alumni. The interviews and surveys revealed that different types of global issues were impactful in developing social responsibility ideas before college for some students, including service projects in global settings, international travel more generally, and awareness of global poverty and development issues from the news and media. During college, social responsibility ideas were shaped by courses with international content (inside and outside of engineering), international service-related groups (e.g. Engineers Without Borders), study abroad, and work experiences. There was a weak negative correlation between students' average social responsibility attitude overall and their level of interest in living domestically; and a weak positive correlation between their professional connectedness and interest in living internationally in a developing country. The strength of these correlations varied by student gender, rank, and major. The results suggest that these correlations might result from causation in either direction: individuals may develop stronger attitudes toward socially responsible engineering as a result of global experiences before and during college, and/or those with a stronger sense of social responsibility may seek out international experiences during or after college. However, the quality of international experiences can be variable and may impact students in different ways. As a result of these experiences, interest in working abroad changed during their undergraduate engineering education for some students. The results suggest that initiatives to globalize or internationalize college experiences may help to combat the "culture of disengagement" in relation to engineering students' commitment to socially responsible engineering.

Background

There is a need for engineers to use their skills to contribute to solving global problems. While progress has been made, such as in strides toward achieving the UN Millennium Development Goals [1], much work remains as highlighted by the UN Sustainable Development Goals [2]. The National Academy of Engineering considered the role of engineering in meeting these needs in 2004, stating: "We aspire to a future where engineers are prepared to adapt to changes in global forces and trends and to ethically assist the world in creating a balance in the standard of living for developing and developed countries alike." [3, pg. 51] It is unclear to what extent students themselves might aspire to this application of their engineering skills.

Professional social responsibility describes the extent to which individuals feel a moral obligation to apply their engineering skills to help society and/or the environment. The Professional Social Responsibility Development Model (PSRDM; Figure 1) proposes that professional social responsibility attitudes develop when an individuals' personal social responsibility attitudes merge with their sense of professional competency and a recognition that engineering has the ability to help people and society [4]. Engaging in applying one's engineering skills to serve then activates a cycle that reinforces one's motivation to help.

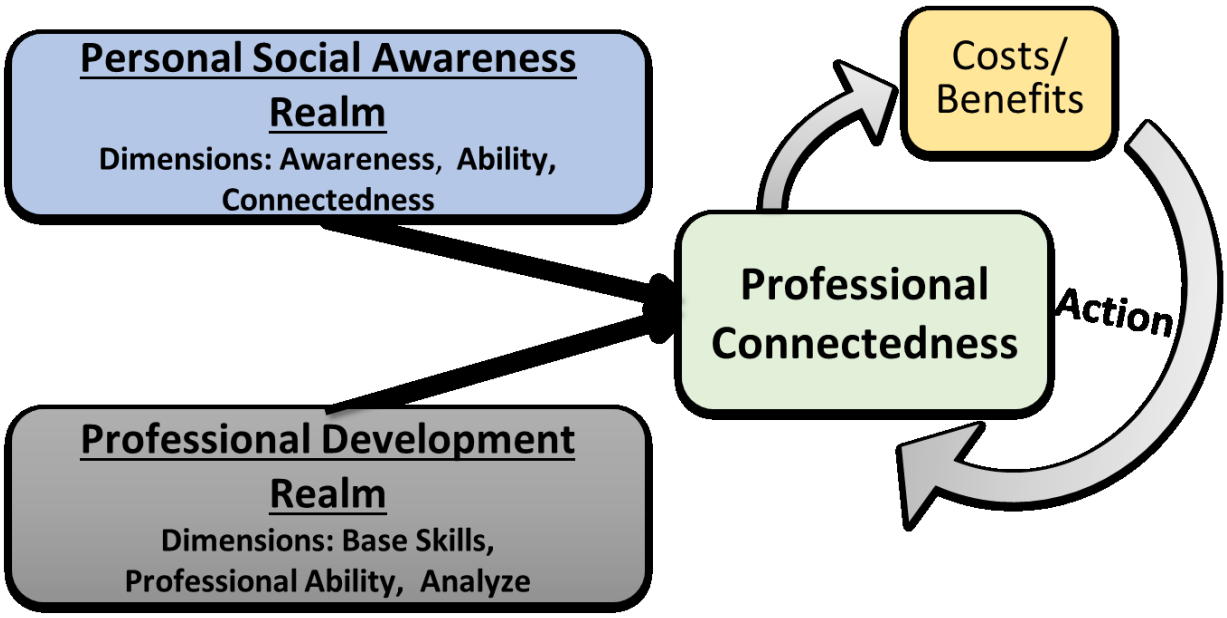

Figure 1. Professional Social Responsibility Development Model showing eight dimensions (adapted from [4])

The Association of American Colleges & Universities (AAC&U) has recognized the potential reinforcing nature of social responsibility and global learning [5]. Looking more deeply at the eight dimensions in the PSRDM, one can hypothesize linkages between social responsibility attitudes and exposure to global issues. Within the personal social awareness realm (drawn heavily from the attention phase of Schwartz's altruistic helping behavior model [6]), seeing global poverty and needs either first-hand when traveling or via news and media would build one's awareness of problems. Meeting and befriending others who have experienced a lack of infrastructure and technology that most American's take for granted could engender feelings that actions should be taken to help. Engaging in global mission trips with church or school groups could powerfully demonstrate one's ability to help address those problems. In the professional development realm, feelings that the application of engineering has the potential to contribute to solving social problems (professional ability) could grow from an awareness of the global service activities of groups like Engineers Without Borders (EWB) and Bridges to Prosperity (B2P). The third dimension of the professional development realm involves analyzing the social dimensions of problems where engineering is being applied. Global case studies in courses might serve to build this ability among engineering students. Finally, if a student engages in global engineering service projects, either in courses or co-curricular groups (like EWB), this engagement could reinforce one's feelings of professional connectedness. While these linkages can be hypothesized, they have not yet been rigorously verified. One could also envision that if global experiences and/or knowledge contributed to growing one's sense of professional social responsibility that they might be motivated to act on those feelings by working on projects that apply their engineering skills outside the U.S. to serve those with great need.

There have been calls to educate engineering students with global competencies [3, 7-9], along with a broader movement to internationalize higher education [10-12]. Within some of the myriad definitions of global or international competencies, elements of social responsibility

development can be found. For example, Deardorff [13] included "valuing others' values, beliefs, and behaviors…" among global competencies. Sandekian and Giovanelli [14] noted that engineers with global competency would act with forethought of the far-reaching consequences of engineering, both physical and social, as well as cultural sensitivity. The importance of cultural sensitivity and adaptability were also acknowledged by Russo and Osborne [15]. Thus, there appears to be overlapping elements between engineering's professional social responsibility development and global competencies.

Surprisingly, some research has shown that during college engineering students may decrease in their desire to apply engineering to help others [16-18]. Cech [18] found a "culture of disengagement" among undergraduate students at four institutions. The messaging in the National Academy of Engineering's "Changing the Conversation" [19] seems to have taken root, inspiring students to pursue engineering due to their desire to help people, society, and/or the environment. However, these aspirations appear to diminish over time in some engineering students. The college environment is expected to be impactful to students in a number of ways, including growing or diminishing professional social responsibility attitudes [20]. It is likely that international work aspirations might also change. Further, previous research has found differences among demographic groups in social responsibility attitudes, including by gender (women > men), discipline (environmental > civil > mechanical), and rank (seniors < first-year) [17, 21]. Thus, one might expect similar differences in the extent that Social Responsibility (SR) correlates with future international work interests among these groups.

Research Questions

Two research questions related to intersections between social responsibility and international experiences / interests were explored:

RQ1. If and how have international experiences and learning about international contexts been important to developing engineering students' sense of social responsibility?

RQ2. Does the importance of living inside or outside the U.S. relative to other job factors correlate to SR attitudes? Does this differ by rank, gender, or discipline?

Methods

The research used a mixed-methods approach, combining quantitative data from survey responses with qualitative data derived from interviews and open-ended survey responses. The study was approved by the institutional review board for human subjects research.

Quantitative Survey Data. A large set of survey data was used to explore potential correlations between international work location interest and social responsibility (RQ2). The second question on the survey asked students to indicate the relative importance of eight future job qualities by distributing 10 "stones" (representing importance) among these "bins": salary, helping people, working on industrial/commercial projects, working on community development projects, living domestically, living internationally in a developed country, living internationally in a developing country, own your own business (be self-employed). The students also answered 50 Likert-type questions related to social responsibility attitudes using a 1 to 7 scale (Table 1). Previous work has shown strong evidence of validity for these items [22]. The average across

these 50 items represents students' overall social responsibility attitude. Two sub-categories of SR were of particular interest: professional connectedness (19 survey items) and analyze (5 survey items). The survey also included an open-ended question: "briefly describe events that influenced your views of community service and social responsibility." The 2014 survey included an additional open-ended question that asked whether or not any college courses had influenced their views of social responsibility, and if so to describe what courses and in what ways. The surveys concluded with demographic items: gender, rank, major (undergraduate and graduate).

Table 1. Quantitative measures of social responsibility

SR dimension	**Description; *Example survey item***	**Survey Items[1]**
Analyze	Recognize the importance of social aspects and stakeholder input into the engineering process; e.g. *It is important to incorporate societal constraints into engineering decisions*.	5 (1N)
Professional connectedness	Responsibility of engineers to help others; e.g. *I feel called to serve others through engineering.*	19 (5N)
Overall SR	Personal social awareness realm that includes recognition of needs, feeling one has both the ability and obligation to help others; e.g. *It is my responsibility to take some real measures to help others in need*.	13 (4N)
	Professional development realm (including analyze) focuses on inclusion of social considerations and understanding social context in engineering; e.g. *Engineers can have a positive impact on society*.	14 (3N)
	Professional connectedness	19 (5N)
	Costs-benefits: trade-offs associated with engaging in socially responsible engineering or service; e.g. *I would be willing to have a career that earns less money if I were serving society*.	4

[1] (Number of the survey items that are negatively or reverse worded)

Survey Distribution and Respondents. In fall 2012, a survey invitation was distributed to entering first-year students, seniors, and graduate students majoring in civil, environmental, and mechanical engineering at five institutions. In addition, in spring 2014 the survey invitation was emailed to all undergraduate engineering students at 17 institutions. Further details on these methods can be found in [17] and [23]. The data from the fall 2012 and spring 2014 survey administrations were combined into a single set of 3303 responses. IBM SPSS software was used to evaluate potential correlations using the non-parametric Spearman rho (appropriate for non-normal and ordinal data); 2-tailed significance values below 0.05 were considered significant. *Cocor* was used to compare correlation factors for significant difference [24]; p-values below 0.10 were considered significant.

Qualitative Data: Surveys. Open-ended questions on the survey sometimes elicited responses that included international themes. Emergent themes related to international issues were used to create codes, and each response examined to determine if it represented an instance of the code. Some activities imply others, but single instances in the responses were only coded under the most "immersive" theme. For example, an individual participating in study abroad could be considered to have also traveled and lived abroad, but only the study abroad code was ascribed to the statement. Similarly, working on an international service project in-country clearly involved travel abroad, but only the international service code was applied. Some individuals did describe

multiple events, and each was coded separately. The EWB theme was particularly challenging to parse out. Some individuals just stated "EWB", so their level of personal involvement in EWB was unclear. Thus, EWB responses were further coded, as possible, with additional codes to clarify if the student is describing an EWB service trip in-country or EWB project work.

Qualitative Data: Interviews. Rich information was generated from semi-structured interviews with 34 students who entered college in fall 2012 majoring in engineering at four institutions. Students were recruited to participate in the interviews using criterion-based selection among incoming first-year students who had completed the fall 2012 survey on social responsibility. The students recruited to participate in longitudinal interviews were selected to encompass a range of attitudes on socially responsible engineering, a mix of gender (over-sampled for female students), multiple institutions (students across four institutions consented to participate in the interviews), and engineering disciplines (survey respondents were primarily majoring in mechanical, civil, and environmental engineering). The cohort of 34 students recruited to participate in the interviews were invited to participate in follow-up versions of the online survey and interviews spring of 2013, 2014, 2015, and 2016. Students were provided a $10 gift card for completing the online survey and $100 for participating in the 30- to 60-minute interview. Students were assigned pseudonyms. Among the original cohort of 34 students, eleven students transferred out of engineering majors and/or left college. Others students did not participate in interviews every year. The interviews were semi-structured across of range of topics including what students had been doing in academics the previous year, future goals for career, and social responsibility. No questions asked specifically about international elements. The interviews were audio-recorded, and written transcripts generated. Emergent coding methods were used to explore themes related to international issues [25].

A second set of interviews were conducted with 19 "alumni" who graduated with engineering bachelor's and/or master's degrees and had participated in engineering service programs in college. The semi-structured interviews asked individuals to describe their time approaching graduation, choosing a job, and career choices, motivations, and experiences. These interviews were explored for themes related to international issues and social responsibility, in order to add additional richness to this exploratory study.

Institutional context. The engineering students who participated in the interviews were initially attending four institutions: a large public institution with highest research activity (LPU), a technically-focused public institution with high research activity (TU), a medium-sized private institution with highest research activity (PrU), and a medium-sized public institution with high research activity (MPU). Students from these same institutions also comprised a large percentage of the survey respondents that spanned 17 institutions in all (26% LPU, 20% TU, 9% PrU, and 7% MPU). A brief overview of key elements at the four institutions as they relate to international context follows. All four institutions had strong student chapters of EWB-USA on campus. LPU has a strong tradition of graduates entering service in the Peace Corps. In addition, there were international certificates and minors offered in the College of Engineering. At TU there was a program focused on engineering for developing communities, an international option for senior design, and a robust study abroad program. Within the general education requirements for all students attending the institution was a requirement on "global literacy and human culture". Among four required "core courses" is included a 3-credit first-year course on Global

Issues (which could be replaced with a 3000-level language course). PrU also had many study abroad programs, but no specific requirements for global education were evident. All of the other institutions participating in the study had global co-curricular programs similar to Engineers Without Borders. More information on the institutions who participated in the survey has been published [26].

Results and Discussion

RQ1. How global issues relate to social responsibility

There were 2652 individuals who wrote in a response to the survey prompt "describe any events that have influenced your views of community service and social responsibility". However, a number of the responses were 'no' and 'NA'. Among those who actually described events in answer to the question, 469 included an international theme and 2044 did not clearly reference international context and were therefore not coded (e.g. a mission trip to unspecified location). Exploring the survey responses that included international issues, 16 different themes emerged (summarized in Table 2). Some responses included multiple international issues. The most common response that included international elements were individuals who described participating in service or mission trips abroad (and it was unclear that the trip included engineering elements). More general travel outside the U.S. was also impactful for many students. Engineering service groups involved in international activities, Engineers Without Borders (EWB), Engineers for a Sustainable World (ESW), and Bridges to Prosperity (B2P) were also mentioned (and unclear that students were actively involved in projects or travel outside the U.S.). Many of the global ideas across the different themes were associated with poverty or developing communities, but not in all cases. Most individuals wrote-in short responses that described what, but did not explain how the event was impactful for their views of SR. The interviews with students and alumni provide more insight.

Table 2. Global themes in open-ended survey question

Theme	Example Quote from Survey	n
Service / mission trip abroad	Service trip to South Africa. Participated in prior to college … was most impactful of all volunteer activities.	124
Travel outside U.S.	I have traveled to many other countries. China, Italy, Mexico, Honduras, and Costa Rica to be exact. It pains me to see children begging on the street, and whole communities living in destitution.…. We should be doing everything possible to raise ALL of humanity from unimaginable poverty to a quality of life comparable to that of the average American.	104
EWB, ESW, B2P	An Engineers Without Borders event that I attended in college showed me how engineers even as undergrads can be helpful in providing aid in developing countries.	103
Learned informally or in classes	Studying South Africa post-apartheid and the lingering physical and societal segregation which prevents Blacks from moving out of poverty	42
Project: worked on engineering project with international context / community	I volunteered with Bridges to Prosperity in Bolivia for a summer to build a pedestrian footbridge in a rural area. This shaped my views about community service and engineering and how I can make a difference using my skills.	41
Charity: Participated in charitable organization with international focus, e.g. global poverty allev.	Volunteering for … Feed My Starving Children… influenced my view on social responsibility because these organizations show that even people without specific skill sets or a lot of extra time can make difference for families that are struggling to meet their basic needs.	30

Theme	Example Quote from Survey	n
Lived abroad	I lived in Ecuador for the past 15 months, which significantly changed my views on life, society/social functioning, and social responsibility.	26
News	Seeing all of the people in need during the time of disaster. Ex. Hurricane Katrina, tsunami in Indonesia	26
Study abroad	Studying abroad in Costa Rica really opened my eyes up to how most of the rest of the world lives. I feel I could use my engineering skills to help solve problems in countries that are struggling to overcome transportation problems.	23
Grew up abroad	Growing up in a developing nation and as a middle class family person. Feeling the need to give back something to my society itself and thus those in need.	18
Peace Corps service	Service in the Peace Corps has made me think about the role that Westerners play in developing countries and that the best way to fulfill our social responsibilities to help others might look very different than to how it is currently happening.	14
Military experience abroad	While in the military I spent seven months in Western Africa building schools, medical clinics, wells and other projects. This had a great influence on my views of making a difference to the underserved population.	8
People: Know or have met individuals who have lived abroad, such as refugees	I volunteer weekly with international refugees in my area. This shows me that there are people from all different backgrounds who need my help. I can learn from them and expand the way I think.	8
Family: live(d) abroad, including parents	Growing up in a low-income and immigrant family.	7
International Students: have interacted with international students	In both high school and middle school, I've come in contact with a number of international students; whether residents or exchange. Talking with them about a variety of cultural topics has broadened my views towards the different ways different people approach the same issue... It's extremely important for others to be exposed to multiple cultures...	6
Know others involved in international service or travel	My second cousin participated in a volunteer trip to Ghana, Africa, that served as an inspiration for not only her but our whole family. … my science teacher fundraised and personally oversaw the instillation of a water purification system for a community in Africa. Both inspired me to be more aware of possibilities for me to have an effect on the world.	6

Global experiences before college

In a number of cases, international experiences before college were important in inspiring students' interest in SR, and potentially socially responsible engineering. Within the group of 238 incoming first year students who participated in the fall 2012 survey, in response to the question "Briefly describe any events that have influenced your views of community service and social responsibility" the majority described local and/or domestic community service participation as influential (often the specific location of the service was not described, but inferred to be in one's local community). However, 22 described international experiences, service, and/or awareness as being influential. This was a fraction of the 68 who indicated that an international experience (to travel) was among the factors that motivated them to participate in service. This seems similar to the ideas of "going isn't knowing" [27] and voluntourism [28, 29]. The students and alumni who participated in the interviews discussed these pre-college international experiences in more detail.

One of the alumni interviewed, Sam (pseudonym), did not head to college right after high school, but spent a year living and working in an orphanage in Mexico, performing international service. He entered college double majoring in pre-med and Spanish, thinking he "would do more medical aid in other countries." But he enjoyed calculus in his first year, so he transferred to engineering and got involved in Engineers Without Borders, "a venue to… help making the world a better place and my engineering skills." This individual had career aspirations to help people, and saw engineering as a vehicle to achieve these helping goals.

International travel before college was discussed by students in their interviews as being influential to their views of SR. One student illustrated this idea by writing: "It made me more empathetic being able to see all the people there who don't have as much as we have in the U.S. …." Another example was from the student interviews (Tim, year 1):

> *Tim: If you build a well in Uganda… you just have to feel good about the fact that you made someone else's life better. Especially in Third World countries when you can upgrade them from something you think is horrible to something you still think is pretty bad, but they think it's amazing.*
> *Interviewer: Have you traveled outside the U.S.?*
> *Tim: Yeah, I went to Mexico and built a house down there and then I went to New Zealand for vacation. Mexico was the big one. I went in eighth grade with my church too.*

Some first-year students also described talking with others who had traveled abroad who had described seeing poverty, and this more indirect awareness also contributed to their sense of SR. For example, Tim noted that his "brother's wife went to Africa for 4 months" and observed poverty and noted how a "charity" model of giving away shoes had consequences different than were intended.

Other students discussed their awareness of global poverty and feeling fortunate to live in America, with this "global viewpoint" fostered in high school:

> *Jackie, Yr1: I feel like it's mostly from my school. I grew up in a school where they really encouraged volunteering, also encouraged a global viewpoint rather than just a local viewpoint. I feel like that's where I get part of my…most of my views on social responsibility.*

Other pre-college experiences related to global issues that students described as influencing their views of SR included awareness from the media and knowing people from outside the U.S. For example, Phillip, one of the alumni interviewed, discussed that his father grew up in Latin America, which motivated his interest to work in Latin America. After discovering more need for civil and water-based engineers in Latin America, he switched his major from mechanical to civil engineering. Thus, his international interests impacted his engineering interests, and the 'social responsibility' aspects were less clear; EWB provided an opportunity to travel to Latin America during his undergraduate studies and he later switched engineering firms to be with a firm that had more of an international presence with the hope to expose his own children to living abroad.

College courses

On the 2014 survey, individuals were asked to describe courses that influenced their views of SR or community service. Among 1225 respondents who described courses that were influential to

their views of SR, 242 (20%) included international elements in their description. These course settings included both technical courses and humanities/social science courses (e.g., "I took cultural anthropology, and while that's not an engineering course, it helped me develop broader views on different countries and their cultures. It made me think a lot about ethnocentrism."). Many of the engineering courses included projects with international context and/or service projects for communities outside the U.S. (e.g., "My senior design project also is instilling social responsibility within me. We are designing a water distribution system for a community that doesn't have running water in a developing country.") Descriptions included topics in the course (e.g. "I took a public health course this semester, and we talked about a lot of current public health issues, both internationally and in the U.S. … [spurred] thinking that we should be helping other countries"), as well as instructor-related elements (e.g., "Engineering projects – [instructor] discussed Bridges to Prosperity and his own experiences in Nicaragua.")

In the interviews, a number of students described courses with global elements as influential to their views of social responsibility. Some students discussed international issues during their interviews near the end of their first year of college. Examples include:

- Jamie described a World Cultures course that "opened [her] eyes to a wider array of things to think about"
- Shawn described how his humanities course made him more conscious of the world and what can be done to help
- Maggie took a course in global development
- Derek discussed international product development
- Miranda described a professor who talked about global travel and pharmaceutical development
- Tanya stated that the professor of her engineering survey course showed different engineering projects around the world
- Trevor described that his engineering survey course professor helped people via engineering work in Central America, and this made him feel obligated to do the same. He also described a course in Community Development and Applied Economics that was "all about social responsibility and underdeveloped countries…."

Far fewer students who continued in engineering degrees talked about international issues in their courses in later years. This may indicate that engineering students' education narrowed to a more technical focus in later years of the curriculum.

In-college international involvement related to SR

Beyond courses, students and alumni described other international experiences that impacted their views of social responsibility. Reflecting back on his involvement in EWB, Sam noted:

> *[EWB] was a way to use my...my engineering skills to help people; I think that was... a big goal of mine … I think I've kind of always just had a sense of, like, I've been given a lot and fortunate to, like, have a good education and those kinds of things, and that part of my responsibility is to do stuff to help other people who maybe haven't had that kind of opportunity. And I think also, like, there's the romance of traveling and then, like, going on an adventure and that kind of thing.*

This appears to be an example of his feelings of social responsibility motivating participation in EWB, and it is unclear if EWB participation strengthened his commitment to either SR or engineering. In fact, Sam left engineering after practicing for about two years due to frustration

with his company not being very socially responsible with respect to doing what was best for the environment or communities, but rather motivated primarily by profit.

Over half of the engineering students talked about awareness, interest, or participation in EWB during their first-year interview (19 of 34), as they gave examples of SR related to engineering. Some of the students had even heard of EWB before college, with one noting:

> *…when I was looking for colleges, I heard about this awesome program, national program, called Engineers Without Borders. And when I was picking my college, one of the criteria when it came down to it was that the school I was going to had to have Engineers Without Borders… I went on a lot of the church mission trips in high school and to have that impact on the community where they were at a lower level of living standard than what I was used to…. So it was interesting that… I don't have to stop that now since I'm going to college. I can apply what I'm learning in school and have an impact on a third world country. (Miranda)*

However, three of the five students who got actively involved with EWB (including Miranda) transferred out of engineering (but maintained activity with EWB) and others who did get involved in EWB their first year were not involved as juniors or seniors. Thus, the presence and visibility of EWB was a catalyst for students thinking about helping others through engineering, even if students did not engage with EWB to a large degree. Kim described her interest in EWB in her year 1 interview:

> *I have been really busy with my classes and stuff, but I have been looking into the volunteer stuff they have to offer. And I want to do Engineers Without Borders. That seems fun and I really want to travel, so that seems like it will be good…. I went to the intro meeting earlier this semester and they talked about the three different places they go. The one in Africa seemed the most interesting to me because you get to go to make… you get to help people, and you get to hang out with little kids in the orphanage. This seemed interesting because I worked over the summer at kid camps so… I think it's really interesting and I like helping people and, I don't know, it looks good on resumes. And I think it's a fun thing to help people.*

In subsequent interviews Kim did not discuss being involved with EWB. However, her survey responses indicated that she likely attended a few EWB meetings. It may be that some students join EWB more for interest in international travel and building their engineering skills and later become motivated by the good in the world that can result from application of engineering.

One of the alumni, Karl, traveled to Nicaragua as part of a senior research project, which had grown out of an international service-project in his senior capstone design course in environmental engineering. He noted:

> *...poverty, it's one thing to know about it, it's one thing to study about it, … but it's a whole other thing when you are immersed in it and then... if you take it a step further and think how can I help these people, other than just be in poverty and experiencing that...just for me it was an eye-opener… And so I just realized, ...I wanna go this path.... There's a lot more need for a guy doing water and sanitation work than for another officer in the military…*

Study abroad was another internationally-focused college activity potentially influential to views of SR. In the interviews, one student (Todd) described participating in study abroad in two places in two different semesters. However, it did not seem that he related his study abroad experiences

to SR, and these were more an opportunity to experience another culture that was still comfortable.

Even exploring the interviews, the true nature of the interactions between international experiences and SR are not fully evident. While there is extreme poverty and a role for engineering to contributing to improving quality of life and helping others, similar issues exist in communities in the U.S. The theory of 'transformative learning' may be relevant [30-34]. Mezirow [30] described the goal of higher education is to help individuals become "more autonomous, socially responsible thinkers", and linked transformation theory to moral values [30, p. 8-9]. The large differences in culture during international travel or engagement perhaps result in discomfort or 'disorienting dilemmas' [31-34]. Thus, one's awareness of needs is heightened, one recognizes the role that engineering and technology could play in helping, and one's sense of responsibility to help through engineering is catalyzed. However, transformative learning theory stresses the role of critical reflection and discourse in transforming experience into changes in one's attitudes, values, and/or knowledge [30]. None of the interviewees mentioned intentional reflections following their international experiences.

Global Interests After College

There were a number of different students who discussed their global interests after college in relation to their social responsibility.

Tim described ideas for living and working abroad as an engineer during his interview at the end of his first year of college, in response to a question on his thoughts about what is social responsibility. He discussed that his brother was in medical school and planning to do Doctors Without Borders and:

> *…engineers have the same thing, Engineers Without Borders. So that's why I'm taking Spanish. I'd just like to at some point go to a third world country, build a well there, build something to use my skills. I think if you're bettering, if you are only working in just the United States, I mean you got to get out there and help countries who aren't doing as good. I think there is a huge social responsibility of engineers. … At a certain point you have to develop a country because you can't ask countries to start from scratch by themselves especially in the state that the Third World countries are in… they just don't have the resources to help themselves.*

His response demonstrates a 'deficit model' for helping others, and he seems unaware of individuals with unmet needs in the U.S. and the local potential for socially responsible engineering. He also described being exciting about working outside the U.S. in a future career in the Air Force, but did not discuss social responsibility in this context.

Within various interviews over their time in college, five different students discussed an interest in working in the Peace Corps, including Maggie (yr1, yr2; left engineering), Jocelyn (yr1, yr2 less; left engineering), Nelson (yr2; left engineering); Todd (yr2); and Denise (Yr4). Interestingly, three of these five left engineering. Among the group interviewed as seniors in engineering, only Denise, who has family in Colombia, mentioned the Peace Corps as an option among an array of interests:

> *I don't want to fall into a commercial trap just working… I'm not sure how much I like research and have control over what I research. …especially if I want to do the Peace*

Corps to be helping other people…. So that's one option and traveling is one option and working with other communities and helping out that way….

Peace Corps experience was discussed in greater depth by some of the alumni. Andrew worked for a year doing pharmaceutical research as a biomedical engineer before joining the Peace Corps and teaching math and English at a primary school in Nepal. During undergraduate studies, Andrew described volunteering in local homeless shelters, doing a spring break service trip in the U.S., and being "interested in… that work" but didn't consider "devoting a whole lifestyle to that." Reflecting back, he noted, "what was missing from my undergraduate career, was that … it *was* kind of disconnected from helping people…." However, he had enough interest to apply to Peace Corps in his senior year, and was accepted but deferred to work in engineering. He described his engineering work as "I was making… pharmaceuticals that *would* help people, but I was so disconnected ..*from* the people." After Peace Corps and during graduate studies in a unique engineering for developing communities program this individual realized, "I wanted to do something as a job that I felt like was connected to people and was always helping." However, he sought opportunities to engage in helping through teaching or jobs in the U.S. because "...I wasn't ready to...to *move* overseas and live there…. that seemed like that wasn't the lifestyle that I wanted at that point in my life." But despite these hesitations, "I got married and I moved overseas and I taught in Kuwait for... a couple of years." He was currently teaching fourth graders in the U.S., stating "I think living in a developing country, doing [water and sanitation work] is...just not easy. …that's… not necessarily the lifestyle that I want…. I've got kids...and my wife and I had talked about moving overseas with the kids, and I think I would like the stability that I had in Kuwait of working at an international school...."

Another alum, Nico, earned a BS in philosophy and English literature, and during his undergraduate career "sought out … opportunities to try and give back a little here and there" such as working at the local homeless shelter. He stated "I don't know, where sort of my social motivations come from, maybe from my mom or my parents, I guess, or something in my family." After college he joined the Peace Corps and worked in Peru and El Salvador primarily as a community health volunteer, but ended up working primarily on water and sanitation projects. This experience motivated him to get a degree in engineering to "continue that line of work… internationally in the development space." He was in Uganda at the time of the interview, working for a non-profit focused on water and sanitation while completing research for his doctoral degree. He did not yet have definite long-term plans, noting "sometimes I have my moments where I get pretty burned out on the development sector, and then I have my moments where it's really quite rewarding."

Among all of the students, Todd had the greatest and most persistent international interest based on the survey. In the year 1 interview, nothing came up that led Todd to discuss those interests. However, in year 2 Todd was studying abroad in China, saying "I always knew that I wanted to go abroad." He elaborated that he was not taking engineering courses during the semester abroad, but was "just here for language". In response to a question about his ideal career, Todd stated: "I have one idea… Obviously I'm into international travel… I really enjoy it and meeting people and new cultures, yeah. … So in my penchant to travel, there are options for engineers to go work in developing nations. There is some demand there, and I haven't looked into it a lot, but that is something I would like to check out definitely before I graduate. Another [ ] program

where you can go work with the Peace Corps and you can go work with them, and you can get your Masters at the same time. So that's an option …." In his year 3 interview he discussed feeling pessimistic about global issues like climate change and "Looking at the pollution in China has kind of had an effect on me…." During the fourth year interview, Todd was in Portugal doing international senior design. He describes working with an international team of multidisciplinary students. Asked about particular kinds of jobs he was interested in for the future, Todd again discussed wanting a job that "lets you travel." The majority of Todd's international interests did not seem related to social responsibility.

RQ2. Importance of Living Internationally During Career

In response to the future job qualities question on the survey, students could allocate between 0 to 10 stones into eight bins representing the importance they ascribed to that future job characteristic. Among the eight bins, three related to the location where one would live: living internationally in a developed country, living internationally in a developing country, and living in the U.S. Among the 3303 survey respondents, 2697 (82%) placed some level of importance on where they lived as a factor among future job qualities. This ranged from 0 to 8 stones for living domestically (66.5% 1 or more), 0 to 6 stones for living internationally in a developed country (42.7% 1 or more), and 0 to 5 stones for living internationally in a developing country (24.2% 1 or more). Figure 2 is a box-and-whisker plot which illustrates that individuals with more interest in living domestically or internationally in a developed country had somewhat lower professional connectedness, and a trend to increasing professional connectedness with increasing levels of interest in living internationally in a developing country. Similar trends were found for overall SR (Table 3).

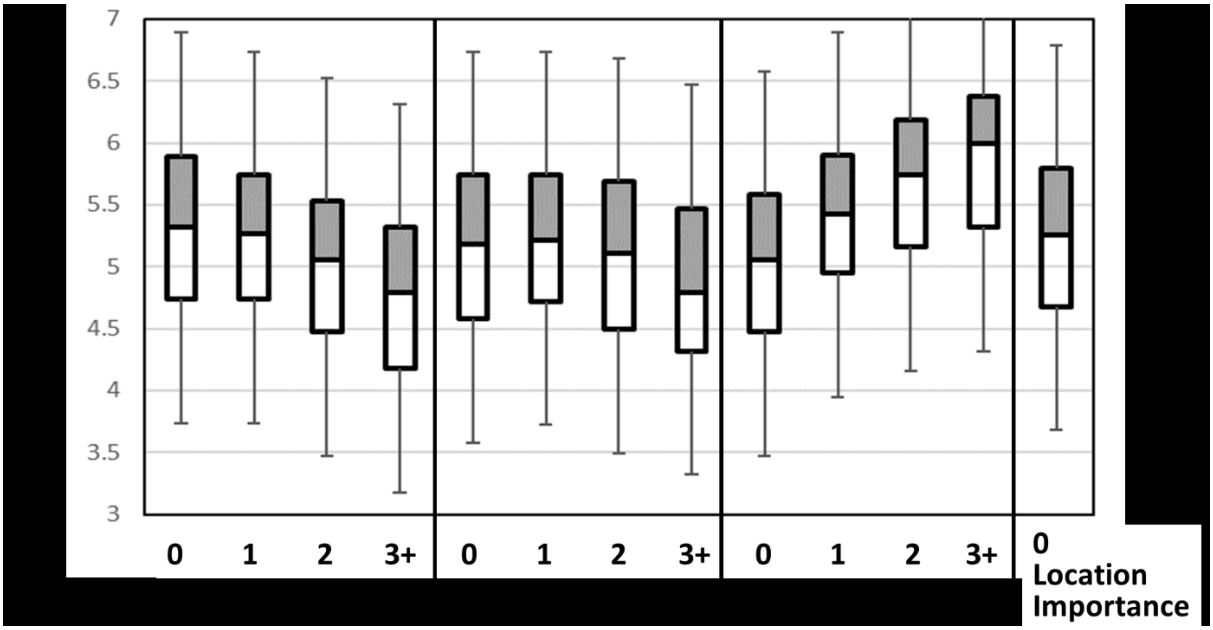

Figure 2. Professional connectedness scores of students placing different amounts of importance weight on where they live for their future job (x-axis), showing median (center of the box), first quartile (bottom of the box), third quartile (top of the box), and minimum/maximum scores (the whiskers).

Table 3. Median overall SR scores among engineering students placing varying importance on living location among future job qualities

Number of stones	Living Domestically	Living Internationally in a Developed Country	Living Internationally in a Developing Country	No location preference noted
0	5.62	5.53	5.46	5.57
1	5.58	5.59	5.71	
2	5.47	5.49	5.89	
3+	5.28	5.36	6.00	

Weak but statistically significant correlations were found among some of the work location preferences and social responsibility dimensions (Table 4). Across all students, there was a positive correlation between the amount of interest in living internationally in a developing country with professional connectedness, overall SR, the analyze dimension. There were weaker negative correlations between interest in living domestically and professional connectedness, overall SR, the analyze dimension. There were not statistically relevant correlations between students' amount of interest in living internationally in a developed country and social responsibility (data not shown). The results seem to imply somewhat of an "EWB-type" service model in engineering education. That is, individuals most motivated to serve and help others see a critical need for this in settings outside the U.S. in so-called 'developing' countries. A previous study at a single institution found that future global work interest and concern for others as engineers were significantly correlated among first-year students majoring in environmental engineering, but were not significantly correlated for first-year civil and architectural engineering students [35]. To some extent this perspective neglects the important needs domestically, such as homelessness and poverty in our own neighborhoods. This may reflect a deficit view of other countries and/or paternalistic attitudes [36-38]. In addition, the weak correlations indicate that a number of other personal and/or educational factors are likely relevant in determining an individuals' interest in living outside the U.S. and their social responsibility attitudes.

Table 4. Spearman rho correlations among social responsibility scores and amount of importance in living location among future job characteristics

SR Category	Student group	n	Median	Living Domestically	Living Internationally in a Developing Country
Overall SR	All	3300	5.60	-.157**	.220**
Analyze		3300	5.60	-.094**	.157**
Professional connectedness		3300	5.16	-.188**	.250**
Professional connectedness	Female	1122	5.42	-.211**	.280**
	Male	2090	5.05	-.165**	.213**
Professional connectedness	First-Year	507	5.16	-.145**	.290**
	Sophomore	609	5.28	-.171**	.280**
	Junior	573	5.05	-.222**	.279**
	Senior	910	5.16	-.186**	.230**
	Graduate	523	5.26	-.183**	.186**

SR Category	Student group	n	Median	Living Domestically	Living Internationally in a Developing Country
Professional connectedness	Mechanical	1122	5.05	-.191**	.208**
	Civil	593	5.37	-.168**	.232**
	Environmtl	382	5.53	-.118*	.267**
	Electrical	226	5.05	-.243**	.217**
	Computer	226	4.84	-.166*	.137*
	Chemical	126	5.24	.047	.322**
	Biomed	108	5.53	-.116	.236*

** Correlation is significant at the 0.001 level (2-tailed); * significant at 0.05 level (2-tailed)

Demographic factors were shown to impact the strength of the correlations between social responsibility and the importance of living location among future job factors (Table 4). Female students' overall SR, professional connectedness, and analyze dimension scores had stronger correlations with living location importance than male students (see Table 4 and Appendix); correlations between living location and professional connectedness were somewhat stronger than with overall SR or the analyze dimension. The differences in correlation factors between male and female students were only statistically significant for *living internationally in a developing country* with *professional connectedness* (p=.0541) and *overall SR* (p=.0744). It is interesting that the same trends in correlations were found, despite lower overall SR and professional connectedness among male students.

Student ranks were explored next. First, the professional connectedness data among students at different ranks did not confirm the culture of disengagement phenomenon found in previous work, evident by the lack of trend in the median professional connectedness scores between first-year and graduate students. The importance of living internationally in a developing country had a decreasing strength of positive correlation with professional connectedness with increasing rank (Table 4; first-year vs. graduate students p=0.0744). For living domestically, negative correlations with professional connectedness were the weakest among first-year students; however, differences in the correlation factors were not statistically significant (e.g. first-year vs. juniors, p=0.1922). Similar trends were observed for correlations among living location with overall SR and analyze scores (Appendix), but with weaker correlations.

Potential differences among students in different majors were also explored. Quantitative analysis was limited to disciplines with over 100 respondents. The median SR attitudes differed among disciplines, with the highest professional connectedness among students majoring in environmental and biomedical engineering and the lowest among computing majors; similar trends were observed in overall SR scores (Appendix). The strength of the positive correlations between professional connectedness and interest in living internationally in a developing country varied among majors, from a high of 0.322 in chemical engineering to a low of 0.137 in computing (p=.081). Correlations between living domestically and professional connectedness also varied from the largest negative correlation among electrical engineering majors to no significant correlation among chemical engineering majors (p=.0086). Similar trends were observed between overall SR and living location, but with weaker correlations (Appendix).

Limitations

One limitation of the quantitative analysis was that demographic factors were individually analyzed, versus multi-parameter approaches. This is important given that different majors had very different representation of female students among the survey respondents (e.g. 57% female among environmental, 26% female among electrical and mechanical). In addition, students' true social responsibility attitudes may not be accurately represented by the survey results, as the responses could be subject to social desirability and/or acquiescence response bias [39-40].

The qualitative findings are emergent and exploratory. The authors did not have explicit hypotheses about international links to social responsibility attitudes going into the study, and therefore did not explicitly ask students about international elements during the interviews which focused on SR. As well, the interviews represent a range of student and institutional characteristics, but should not be considered exhaustive.

Implications for Future Research

These exploratory findings provide interesting questions for future research. Interviews with targeted questions could uncover what motivated students to join various internationally-focused experiences including study abroad and international service activities. It is expected that multiple factors would be influential, and students could reflect on the relative importance of these factors. It might be interesting to query these motivations both before and after the international experience, due to the accuracy of recalled experience and the fact that whether or not aspirations were met could influence one's recall of initial motivations.

Some institutions and engineering programs devote significant attention to study abroad programs and have explicit goals for the percentage of students who participate in these programs. The majority of these opportunities tend to focus on developed countries [10, 11] where the impacts of international engagement on SR were less evident. This is an area for future research; the survey instrument could be given to students before and after their study abroad experience which might identify settings that led to changes in attitudes toward socially responsible engineering. Program changes could be piloted, such as incorporating a community service project (which may or may not have be engineering related) into the abroad experience and requiring a set of structured reflections around disorienting dilemmas. These changes could create more visible connections between international settings and SR. Upon returning to the U.S., students' perceptions may have changed which increase their awareness for socially responsible engineering in all settings (e.g. observe greater environmental commitment in EU countries that translates into their standard of care). Focus group discussions among cohorts of returning students might serve a dual-role of catalyzing student awareness and assessment. These are only a few ideas for myriad future research exploring connections between international elements and engineering student attitudes toward social responsibility.

Summary and Conclusions

Students identified a number of different types of international experiences and international-related elements as being influential to their views of social responsibility and/or community

service. This included experiences before and during college. The majority of these were not specific to engineering service, but the PSRDM theory posits that personal social responsibility may lead to professional social responsibility attitudes. Transformative learning theory posits that situations or settings which students find uncomfortable or posing 'disorienting dilemmas' may lead to learning and/or change; these situations may be more likely to occur associated with international settings. However, the theory also points to the importance of reflection and dialogue around these issues. Thus, educators interested in increasing engineering students' sense of professional social responsibility should structure opportunities for reflection or discussion around study abroad, international experiences, and international settings. This might include inviting international students on campus to share their experiences with U.S. students, which would not require large monetary investments that are frequently associated with international travel.

Mathematical relationships were found whereby stronger social responsibility attitudes (particularly professional connectedness) were positively correlated with the extent that individuals placed an importance on future work abroad in developing countries. Students likely perceive the largest need for engineering to help in some of the poorest countries. While admirable, engineering educators should also carefully consider how they discuss non-U.S. communities, avoiding language that may inadvertently encourage deficit models of others or paternalistic attitudes. This training seems particularly important to foster respectful partnerships with global communities.

Acknowledgments
This material is based on work supported by the National Science Foundation under Grant #1158863. Any 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 National Science Foundation.

Appendix. Spearman correlations between overall SR scores or Analyze and interest in living location for different demographic groups

	Overall SR			Analyze dimension of SR		
Student Category	Median	Spearman correlation with Living Domestically	Spearman correlation with Living Internationally in a Developing Country	Median	Spearman correlation with Living Domestically	Spearman correlation with Living Internationally in a Developing Country
Female	5.80	-.183**	.247**	6.00	-.126**	.171**
Male	5.48	-.130**	.184**	5.60	-.059**	.122**
First-Year	5.60	-.114**	.254**	5.60	-.057	.138**
Sophomore	5.68	-.153**	.251**	5.60	-.100*	.164**
Junior	5.56	-.177**	.240**	5.60	-.072	.221**
Senior	5.57	-.160**	.203**	5.80	-.112**	.121**
Graduate	5.60	-.151**	.165**	5.80	-.095*	.157**
Mechanical	5.52	-.167**	.184**	5.60	-.097**	.140**
Civil	5.70	-.131**	.209**	5.80	-.105*	.123**
Environment	5.80	-.075	.238**	6.00	-.051	.182**
Electrical	5.48	-.207**	.167*	5.40	-.072	.124
Computer	5.38	-.133*	.146*	5.60	-.035	.083
Chemical	5.59	.093	.273**	5.60	.042	.207*
Biomed	5.76	-.088	.184	5.80	-.057	.066

** p<.001, *p<.05

References

[1] United Nations. *The Millennium Development Goals Report 2015*. New York: UN.

[2] United Nations. *Sustainable Development Goals*. https://www.un.org/sustainabledevelopment/ [Accessed Jan. 21, 2019].

[3] National Academy of Engineering, NAE. *The Engineer of 2020: Visions of Engineering in the New Century*. Washington D.C.: National Academies Press.

[4] N. Canney, A. Bielefeldt. "A Framework for the Development of Social Responsibility in Engineers." *International Journal of Engineering Education*, vol. 31 (1B), pp. 414-424, 2015.

[5] Association of American Colleges & Universities (AAC&U), *Shared Futures: Global Learning & Social Responsibility*. https://www.aacu.org/shared-futures [Accessed Jan. 25, 2019]

[6] S. H. Schwartz and J. A. Howard, "Helping and Cooperation: A Self-Based Motivational Model," in *Cooperation and Helping Behavior: Theories and Research*, New York: Academic Press, Inc., 1982, pp. 327–353.

[7] J.M. Grandin and E.D. Hirleman. "Educating Engineers as Global Citizens: A Call for Action / A Report of the National Summit Meeting on the Globalization of Engineering Education." *Online Journal for Global Engineering Education*, vol. 4 (1), article 1, 28 pp., 2009.

[8] NAE – National Academy of Engineering. *Educating the Engineer of 2020: Adapting Engineering Education to the New Century*. Washington DC: National Academies Press, 2005.

[9] NAE – National Academy of Engineering. *Engineering Societies and Undergraduate Engineering Education*. Washington DC: National Academies Press, 2017.

[10] ACE - American Council on Education. *Internationalizing higher education worldwide: National programs and policies*. Washington DC, 2015.

[11] ACE – American Council on Education. *Mapping Internationalization on U.S. Campuses: 2017 Edition*. R.M. Helms, L. Brajkovic, B. Sturthers. 43 pp., 2017.

[12] J. Knight, "Internationalization Remodeled: Definition, Approaches, and Rationales." *Journal of Studies in International Education*, vol. 8 (1), pp. 5-31, 2004.

[13] D.K. Deardorff, "Identification and assessment of intercultural competence as a student outcome of internationalization." *Journal of Studies in International Education*, vol. 10 (3), pp. 241-266, 2006.

[14] L. Giovannelli and R. Sandekian. "Global Engineering: What it Means at University of Colorado Boulder, and How We are Preparing our Students for It." American Society for Engineering Education (ASEE) Annual Conference & Exposition. Paper ID #20023. 2017.

[15] S.L. Russo, L.A. Osborne, "The Globally Competent Student" http://www.aplu.org/projects-and-initiatives/international-programs/comprehensive-internationalization/comprehensive-internationalization-documents/globally-competent-student-russo-and-osborne.pdf [Accessed July 14, 2017].

[16] A.R. Bielefeldt, N. Canney. "Changes in the Social Responsibility Attitudes of Engineering Students Over Time." *Science and Engineering Ethics,* vol. 22(5), pp. 1535-1551. DOI 10.1007/s11948-015-9706-5. 2016.

[17] N. Canney, A. Bielefeldt. "Differences in Engineering Students' Views of Social Responsibility Between Disciplines." *Journal of Professional Issues in Engineering Education and Practice,* vol. 141 (4), 04015004, 2015. http://dx.doi.org/10.1061/(ASCE)EI.1943-5541.0000248.

[18] E. A. Cech, "Culture of disengagement in engineering education?" *Sci. Technol. Hum. Values*, vol. 39(1), pp. 42–72, 2014.

[19] National Academy of Engineering, NAE. *Changing the conversation: Messages for improving public understanding of engineering*, Washington DC: National Academies Press, 2008.

[20] G. Rulifson, A.R. Bielefeldt. "Evolution of Students' Varied Conceptualizations About Socially Responsible Engineering: A Four Year Longitudinal Study." *Science and Engineering Ethics*. Published online 20 March 2018. 36 pp. DOI: 10.1007/s11948-018-0042-4.

[21] N. Canney, A. Bielefeldt. "Gender Differences in the Social Responsibility Attitudes of Engineering Students and How they Change over Time." *Journal of Women and Minorities in Science and Engineering,* vol. 21 (3), pp. 215-237. 2015. DOI: 10.1615/JWomenMinorScienEng.2015011109.
[22] N. Canney, A. Bielefeldt. "Validity and Reliability Evidence of the Engineering Professional Responsibility Assessment Tool." *Journal of Engineering Education,* vol. 105 (3), pp. 452-477. 2016.
[23] A.R. Bielefeldt, N. Canney. "Relationships between Religion, Spirituality and Socially Responsible Engineering." *Engineering Studies,* vol. 8 (1), pp. 66-90. 2016.
[24] B. Diedenhofen, J. Musch, "cocor: A Comprehensive Solution for the Statistical Comparison of Correlations." *PLoS ONE*, vol. 10(4): e0121945. doi:10.1371/journal.pone.0121945. 2015. http://comparingcorrelations.org/ [Accessed Jan. 22, 2019].
[25] J. W. Creswell, *Qualitative Inquiry & Research Design: Choosing Among Five Approaches*, Thousand Oaks, CA: Sage Publications, 2007
[26] A.R. Bielefeldt, N.E. Canney, "Humanitarian aspirations of engineering students: differences between disciplines and institutions." *Journal of Humanitarian Engineering*, vol. 4 (1), pp. 8-17, 2016.
[27] K. Paterson, C. Swan, D. Watkins, "Going is not knowing: challenges creating intercultural engineers." American Society for Engineering Education Annual Conference & Exposition, New Orleans LA, June 26-29, 2016, Paper ID #16399, 18 pp.
[28] N.P. Reynolds, "Is international service-learning win-win?: a case study of an engineering partnership." Dissertation, Temple University, May 2016. 181 pp.
[29] T.S. Soerens, "Beyond voluntourism: examining the motivations and roles of engineering student groups in international development." Proceedings of the 2017 Christian Engineering Conference, Cedarville Ohio, June 28-30, 2017. Pp. 81-89.
[30] J. Mezirow, "Transformative learning: theory to practice." *New Directions for Adult and Continuing Education*, no. 74, pp. 5-12, summer 1997.
[31] E.K. Sharpe and S. Dear, "Points of Discomfort: Reflections on Power and Partnerships in International Service-Learning." *Michigan Journal of Community Service Learning*. Pp. 49-57, spring 2013.
[32] H.L. Bell, H.J Gibson, M.A. Tarrant, L.G. Perry, L. Stoner, "Transformational learning through study abroad: US students' reflections on learning about sustainability in the South Pacific." *Leisure Studies*, vol. 35 (4), pp. 389-405, 2016.
[33] H.T. Rowan-Kenyon and K.K. Niehaus, "One year later: the influence of short-term study abroad experiences on students." *Journal of Student Affairs Research and Practice*, vol. 48 (2), pp. 213-228, 2011.
[34] A. Barge, "The Power of Discomfort in Learning Abroad." Capstone Collection, 3051., 2017. https://digitalcollections.sit.edu/capstones/3051 [Accessed Ja. 26, 2019]
[35] A.R. Bielefeldt, "Sustainable, Global, Interdisciplinary and Concerned for Others? Trends in Environmental Engineering Students." American Society for Engineering Education (ASEE) Annual Conference & Exposition, June 14-17, 2015, Seattle WA, 19 pp.
[36] P-H. Wong, "Technology, recommendation and design: on being a 'paternalistic' philosopher." *Sci. Eng. Ethics*, vol. 19(1), pp. 27-42, 2013.
[37] J.B. Davis, "Transformation without paternalism." *Journal of Human Development and Capabilities: A Multi-Disciplinary Journal for People Centered Development*, vol. 17 (3),, pp. 360-376, 2016.
[38] D.M. Riley and Y. Lambrinidou, "Canons against cannons? Social justice and the engineering ethics imaginary." American Society for Engineering Education (ASEE) Annual Conference & Exposition Proceedings, June 14-17, 2015, Seattle WA, 19 pp.
[39] M.F. King and G.C. Bruner, "Social desirability bias: a neglected aspect of validity testing." *Psychology & Marketing*, vol. 17 (2), pp. 79-103, Feb. 2000.
[40] B. Rammstedt, D. Danner, M. Bosnjak, "Acquiescence response styles: a multilevel model explaining individual level and country-level differences." *Personality and Individual Differences*, vol. 107, pp. 190-194, 2017.