# Creating Inclusive Engineers through Humanitarian Engineering Projects: Exploring the Experiences of Two Students through Interviews

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## Abstract:

This paper provides further results on continuing research studying the impact of humanitarian engineering projects on student professional formation and views of diversity, equity, and inclusion. Through this project, the authors aim to create a more inclusive and equitable engineering workforce by involving students in humanitarian engineering. Previous results from this study have shown positive results from open-ended questions from a survey, but little difference between those who have and have not participated in a humanitarian engineering project from Likert-scaled items. These mixed results from the quantitative and initial qualitative analysis of the survey suggest that further qualitative investigation would better reveal insights for this project's objectives. From the results of the survey, the researchers designed a semi-structured interview protocol to explore the deeper nuances of the impacts of humanitarian engineering projects on inclusive behavior. This paper will focus on the interview of two engineering students who participated in the survey before and after involvement in a humanitarian engineering project. Interestingly, from the survey, it seems that one student was highly impacted by their involvement, whereas the other was not. The interviews with these two students examine their experiences in engineering, their participation in a humanitarian engineering project, and how these experiences connect with their views of inclusivity and equity in the field. The paper reviews the thematic analysis of the interviews through coding and provides a comparison of the two students, their experiences, and their behaviors. In addition to the results from these interviews, the paper also briefly describes the interview design and revision as well as the iterative participant selection process. As next steps, the research team will be interviewing a mixture of engineering students and alumni from Lipscomb University. From these interviews, the team will build a model which may be utilized by other engineering organizations to create inclusive engineers and increase diverse representation in the field.


## Background:

This paper is part of a larger study on the impact of humanitarian engineering projects on student professional formation and views of diversity, equity, and inclusion (DEI) [1-3]. The study builds on a wealth of research around the lack of diversity in engineering [4-7] and the positive impacts of service learning in higher education [8]. Various programs have excelled in integrating service-learning into undergraduate engineering as summarized in the International

Journal of Service Learning in Engineering, Special Issue from 2015 [9]. Generally, programs have seen positive impacts on integrating service into engineering due to the complexity of the real-world projects which require more than simple technical knowledge and skills [10-12]. Though the terms engineering service-learning, community-engaged engineering, engineering outreach, and development engineering are all adjacent, the authors define humanitarian engineering as "developing sustainable, responsible engineering solutions to serve basic human needs." For simplicity, the term *humanitarian engineering projects* (HEPs) will be utilized throughout this paper to cover all similar service efforts in undergraduate engineering education.

This study's objective is to better understand how involvement in HEPs can influence a student's views of diversity, equity, and inclusion. The study employs a mixed method (quan > qual) approach to inform the development of a model to create more inclusive engineers through student participation in HEPs. First, a survey was designed which included Likert-scaled items from two existing instruments, the Engineering Professional Responsibility Assessment (EPRA) [13] and the Valuing Diversity and Enacting Inclusion in Engineering (VDEIE) [14]. The survey also included open-ended questions including "Explain your primary reason for volunteering or serving" and "Briefly describe an event that has influenced your views of diversity, equity, and inclusion." Engineering students from Lipscomb, alumni of Lipscomb's engineering program, and non-Lipscomb engineering professionals were invited to participate in the survey. The research design of the study is detailed in [1], a qualitative analysis of open-ended responses from the survey in [2], and a quantitative analysis of the survey Likert-scaled items in [3]. The survey results informed the selection of interview participants and the interview protocol design for the qualitative portion of the study. This paper will focus on two interviews from current students at Lipscomb with further interviews disseminated separately. Both of the student interviewees participated in the survey before and after involvement in a HEP at Lipscomb. The program model for the HEPs at Lipscomb through the Peugeot Center are detailed in [15]. Further literature and studies will be reviewed with relevant information summarized in the Results sections.

## Methodology:

As described previously, the larger study utilizes a mixed methods approach through a survey (quan & qual) which informed the interviews (qual). The study including the survey questions and interview protocol were submitted to and approved by the Institutional Review Board at Lipscomb. The research questions associated with this study are:

- RQ1: What perceived impact does student involvement in HEPs have on professional formation and perspectives of DEI?
- RQ2: How has involvement in HEPs influenced the professional workplace culture and perspectives of DEI of alumni from Lipscomb?

Students at Lipscomb who completed the survey prior to involvement in a HEP were invited to participate in the survey again following their involvement for a pre-/post-comparison. Two of the five students (S17 & S34) completed the survey pre- and post-involvement in a HEP and were then invited to participate in an interview. Results from an initial analysis of the pre-/post-comparison of S17 and S34 were presented in [3] and a summary is shown in Table 1. From the EPRA, the Connectedness and Professional connectedness dimensions are shown which contain 4 and 15 Likert items, respectively. Connectedness refers to "A feeling of moral obligation, responsibility, or social requirement to help others" and Professional connectedness applies this further as "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 [13]." From the VDEIE, two factors are included from the Inclusive Behaviors construct: Challenge Discriminatory Behaviors and Promote a Healthy Work Environment [14]. The combination of these four dimensions aligns with the focus of this research to study how HEPs may influence or encourage engineers to create inclusive work environments.

*Table 1: Pre- and post-comparison of two student participants in a HEP across two dimensions from the EPRA and two factors from the VDEIE instruments [3]*

| | | ***S17*** | | ***S34*** | |
|---|---|---|---|---|---|
| | | **Pre** | **Post** | **Pre** | **Post** |
| *EPRA Dimensions* | *Connectedness* | 5.75 | 5.75 | 4.25 | 5.50 |
| | *Professional connectedness* | 5.33 | 5.13 | 4.53 | 6.73 |
| *VDEIE Factors* | *Challenge Discriminatory Behavior* | 3.00 | 2.40 | 7.00 | 7.00 |
| | *Promote Healthy Work Environment* | 6.00 | 5.00 | 7.00 | 7.00 |

Briefly, the results showed that S34 increased feelings of moral obligation to help others through their professional capacity following involvement in a HEP whereas there was no noticeable change for S17. Though there were little changes in these factors following involvement in a HEP, S34 exhibited high scores in challenging discriminatory behavior whereas S17 exhibited low scores. The results from the survey were utilized to design additional questions for the interview protocol for the two participants. Note that while alumni of Lipscomb's engineering program are the primary focus of the larger study (seen in RQ2), this paper focuses on the analysis of two student interviews to provide foundational work to better inform and improve the quality of more critical next steps. Additional interviews from other students, alumni of Lipscomb engineering, and non-Lipscomb engineering professionals are expected, and those

results will be disseminated elsewhere. These further interviews will provide refinement of the qualitative analysis and a more robust understanding toward answering the research questions.

Following the survey, the research team designed an initial draft of the interview protocol and performed two pilot interviews with a current student at Lipscomb and an alumnus. From the pilot interviews, the research team found that the interview protocol was not at the high quality expected and that there seemed to be misalignment from the study's research questions. The team sought the guidance of a variety of researchers including an external advisor and a qualitative research incubator group [16]. This was a highly valuable experience for the team and led to an iteratively designed semi-structured interview protocol which better aligned with the study goals and research questions.

The interviews were led by the principal investigator with an undergraduate student researcher ensuring quality by keeping time, following the protocol, and taking notes. The participants completed a consent form prior to the interview and were provided with $60 gift cards following their participation in the interview. For ease of recording, the interviews took place over Zoom and were transcribed using the AI tools on Rev. The transcriptions were then reviewed for accuracy and filler words ("um") were removed for readability. Any identifiers in the transcription were removed and replaced with S17 and S34 where the S indicates the participant is a student and the numbers correspond to the survey results.

Each author then thoroughly read the transcription and wrote a summary of the interviews including highlights or any notes relevant to the primary research questions. Prior to the thematic analysis, the authors reviewed the codebook which was built from the open-ended responses in the survey. The authors then, individually, completed coding of one of the transcripts. During thematic analysis, the authors also allowed codes to emerge from the interviews. Following the first pass, the authors met together to discuss themes and find agreement among codes. New codes were added to the existing codebook and two of the authors continued the process of coding for the second interview. Some of these codes are referenced in the Results section, but the codebook will be further refined with future interviews.

## Results: Participant Comparison

The two interviewees are initially compared as seen in Table 2 which includes data collected in the survey and from the interviews.

*Table 2: Participant information drawn from the survey [3] and interview to provide an initial comparison of student interviewees.*

| | ***S17*** | ***S34*** |
|---|---|---|
| *Student Type* | Traditional | Veteran, First generation |
| *Major* | Civil engineering | Mechanical engineering* |
| *Gender* | Male | Male |
| *Ethnicity* | White | Mixed Race** |
| *Motivation for Engineering* | Experiences in engineering classes in high school*** | Desire to help or serve others |
| *Summary of HEP* | Extracurricular: Site surveying for bridge installation in Honduras | Required course: Micro-home construction for transitional housing in (city) |
| *Survey Results: Inclusive Behaviors (VDEIE [14])* | Decreased slightly across two factors | No change across two factors (high scores for pre- and post-survey) |
| *Survey Results: Professional Connectedness (EPRA [13])* | No change across two factors | Increased in both factors |

**S34 was originally a mechanical engineering major at the time of the survey but switched to a non-engineering major prior to the interview. **S34's actual race and ethnicity was removed from this publication to better protect the identity of the student. ***S17 did not mention a desire to help or serve others through engineering when asked about motivation for choosing the field, but later discussed the HE program as a primary reason for choosing Lipscomb.*

As seen in the table, the identities and experiences of the two interviewees widely contrast with one another except for gender. Interestingly, S34 has multiple markers from underrepresented groups as a veteran, first generation college student, and his mixed race/ethnicity. During the interview, S34 frequently mentions his experience as a veteran, only slightly mentions his mixed-race identity, and did not mention his experience as a first-generation college student. While it is possible that these intersecting identities have an impact on S34's personal life and career trajectory, these did not clearly arise during the interview. Because S34 focuses heavily on his experience as a veteran in the interview, literature and existing studies were examined for comparison. Veteran experiences in undergraduate engineering education have been studied by a joint research group spanning University of San Diego, Purdue University, Clemson University,

and Research Triangle Educational Consultants. A summary of these works is discussed here and are also referenced in the Results section alongside quotes from the interview with S34.

Main et al. suggest a research design focused on studying veteran integration and transition into undergraduate engineering as a basis for in-depth semi-structured interviews with student veterans [17]. A 2019 paper by the same group reviews and analyzes 12 of the interviews considering leadership as the primary framework [18]. Further, a 2021 paper examined the student veterans' perspectives of transition from military to civilian life as an engineering student using the theory of liminality [19]. Focus groups conducted with student veterans found mixed feelings about the transition from the military to college, especially regarding the social transition and support services provided by the university [20].

These markers of S34's identity contrast to those of S17 as a White male, a traditionally overrepresented group within the engineering field. Additionally, S17 didn't mention his identity traits in relation to his experiences at all during the interview. In addition to the demographic characteristics, the two interviewees also contrasted in their reasoning for choosing engineering as a major. S17 initially described his choice of major based on past experiences in engineering classes in high school, but later notes that he chose to attend Lipscomb due to the HE program offered through the Peugeot Center. Though service was not indicated as his primary reason for choosing engineering, it seems that S17 saw the benefits of service through engineering, and this heavily impacted his college choice. In contrast, S34 clearly stated his desire to "work on stuff that's gonna help people" as his reasoning for choosing engineering as a career path. He also mentioned experiences with building things and a working knowledge of engineering from the military as influential as well.

According to two studies, very few engineering students choose the major to help society or for social good at 3.3% (n=390) and 14.4% (n=97) respectively [21, 22]. It's possible that this has changed in recent years due to increases in service-learning or community-engaged engineering and more offerings of humanitarian engineering programs at both undergraduate and graduate levels. Other studies have shown connections between feelings of professional social responsibility and the pursuit of engineering as a career [23] though it's also possible that this connection can influence a student's choice to leave engineering as well to find a career which provides more opportunity to pursue social good [24]. In contrast, S34 chose to leave engineering (see Table 2), not due to a lack of opportunity for professional social responsibility, but rather because of the fear of failing due to the rigor of the major. In the interview, S34 describes disappointment about leaving engineering and the connection to service, but also mentions hopefulness in finding similar service opportunities through his new major.

In addition to these identity and motivations for the two interviewees, the types of HEPs are also briefly described in Table 2. Again, though these projects were carried out with guidance by the same HE program at Lipscomb through the Peugeot Center, the method, location, and nature of

the projects contrasted greatly across the two participants. S17 participated in an extracurricular HEP with international travel to perform site surveying for a future bridge installation in Honduras. In preparation for project completion, S17 met with a team of students, a team leader, and a technical mentor bi-monthly for about 6 months prior to travel. As discussed in [15], all HEPs connect engineering students and professionals with a long-term partner organization to ensure sustainable and responsible completion. S34 participated in a course-based HEP where the students constructed a micro-home for transitional housing for a local non-profit organization in Nashville, Tennessee. The course-based HEP required students to use some class time to work alongside a technical mentor in smaller teams to construct the micro-home over about a 8-week period. A few of the students from the course, including S34, were able to support the transport and delivery of the micro-home on a Saturday following completion of the construction. Though the students had vastly different HEP experiences, the results are presented here side-by-side, not for comparison purposes of the students or projects themselves, but rather to uncover the impact of involvement in a HEP and the HE program model at Lipscomb through the Peugeot Center.

## Results: Qualitative Analysis

The results from the interviews are shown in Table 3 utilizing quotes and summaries for each participant along with interpretations and comparisons in the far-right column. Words bolded and italicized throughout the table indicate codes drawn from either the existing codebook or new codes that emerged during thematic analysis. From S34, ***military experience*** emerged as a predominant code as the student veteran referenced his service multiple times throughout the interview in various ways. Specifically, he described his technical expertise gained through construction as well as leadership experience. Frequently, S34 detailed his leadership style using the phrase ***silent leadership*** which could be summarized as encouraging others to step into roles where they feel they don't belong. S34 mentioned that he learned silent leadership in the military and regularly employed it during his involvement in the HEP. These leadership skills, though not defined as silent leadership, align with work by Main et al. which studied how student veterans enact leadership learned from the military in the classroom [18].

***Group dynamics*** was another new code that emerged from both interviews as the participants frequently referenced working alongside their team members in close proximity with one another as impactful experiences. Interestingly, ***group dynamics*** impacted the two interview participants in slightly different ways. For example, the group dynamics described by S17 seemed to stem from team activities due to close proximity with one another during a weeklong travel and work experience. On the other hand, the group dynamics described by S34 centered around close proximity through technical tasks required for project completion. Though S17 and S34 were involved in different projects and locations, both were impacted by ***group dynamics*** as positive relationship building opportunities within their team. In contrast, both participants also

mentioned ***group dynamics*** as a challenge when confronting discrimination or bias. Pressure from a group to avoid conflict or to not alienate oneself may be a strong driver of silence in instances of prejudice.

The last new code that emerged from the interviews was ***changed behavior***. From the qualitative analysis of the open-ended responses in the surveys, the authors uncovered ***changed perspective*** as a code. There is a subtle difference between these two as defined by the researchers where ***changed behavior*** recognizes a new action or intended action from the participant based on a new learning or reflection whereas ***changed perspective*** might not result in an action. This differentiation is important for this study and the resulting goals as simply changing perspectives or beliefs might not result in the inclusive atmosphere desired, possibly due to ***group dynamics*** as described above. The research team believes that a truly inclusive and equitable atmosphere can only be achieved when both a change in perspective and change in actions or behaviors occur. Further notes are shown after Table 3 with corresponding superscripts within the table.

*Table 3: Interview analysis through quotes, summaries, interpretation, and comparison across the two participants.*

| *Interview Question* | **S17 response** | **S34 response** | **Interpretation** |
|---|---|---|---|
| *If you were to think about your journey toward becoming an engineer as a novel, what would those chapters look like?* | Motivated to pursue engineering based on classes in high school; enjoys accessible, personalized feel at _____; involved with student competition team | Wanted to work on stuff to help people; found supportive and welcoming community in _____ engineering program; redirected out of engineering due to physics course | S17 focused on experience, interest, and social atmosphere whereas S34 prioritized ***helping others*** alongside the social atmosphere[1] |
| *Tell me about your experiences with (HEP).* | "I thought it was a lot of fun." Focused response around ***personal satisfaction*** but also relationships and ***group dynamics*** | "Felt like a dad… I was with all the kids." Openly recognized ***bias & misconceptions*** about younger students abilities | Both focused on the ***group dynamics*** with their team, but S34 included a note about how he brought and overcame feelings of "age-ism"[2] |
| *Do you feel that your involvement in the HEP was important?* | "For the project itself, I would say no, cuz there were 8 of us… we ended up just doing surveying." | "Helping… wrangle the kiddies together." (bias & misconception), included examples of ***silent leadership*** | S17 felt that his involvement was not as important whereas S34 found opportunities to lead among the group |
| *Thinking about who you are today, how does that connect back to your involvement in (HEP)?* | "… cool to see how engineering skills can actually help people in their everyday lives… motivated me to make sure that whatever I do… it's actually benefiting people" | "Reinforced what I want to do, which again is help. Seeing that guy's face when he saw the home, he was ecstatic" | S17 shifted toward a stronger connection of engineering & service whereas S34's connection was reinforced by the HEP |
| *Can you tell me more about the people involved in the (HEP)?* | "I was the youngest… was a good way to meet and connect with some of the upperclassmen… I felt comfortable approaching them with questions…" | "There was even people that were like 17… like a private university… You think they're silver spooned… my view of everyone's changed a lot…" | S34 mentions his ***bias & misconceptions*** around his team, but also how he overcame it; S17 found ***personal satisfaction*** through building ***relationships*** with other students |

*Table 3 (continued): Interview analysis through quotes, summaries, interpretation, and comparison across the two participants.*

| *Interview Question* | **S17 response** | **S34 response** | **Interpretation** |
|---|---|---|---|
| *What impact did the relationships from the (HEP) have on you? (Impactful because of…)* | "The time we spent together, whether just eating dinner or playing games or even the car rides" | "... working hand in hand with someone. So you're able to better bond that way." | Both mentioned ***group dynamics*** as the primary reason why the experience was impactful to the relationships formed through the HEP, specifically in close proximity[3] |
| *How does your experience with the (HEP) team compare to other team experiences you've had?* | Internship: "it was really just me and one other intern… relying on the supervisor to give me guidance… then I go and do it." vs HEP: "felt like we were all one big team and equal and doing everything together." | Similarities: "They're always frustrating to begin with 'cause you're trying to understand your place in that group." & Differences: HEP - "... be they're biggest fan…" vs Other - "I don't have to hand carry someone…" | S17 primarily spoke about differences whereas S34 mentioned similarities too; S17 felt more isolated in his internship whereas S34 felt less need for ***silent leadership*** in his project teams in his new major |
| *How have you learned to work with others who are different from you?* | Referenced working with the partner organization for the HEP & seeing how the partner worked with the community & alongside the team | Referenced growing up in a diverse city & working with people of various backgrounds in the ***military*** | S17 learned to work with diverse groups specifically from the HEP[4] whereas S34 had previous experience with diversity[5] |
| *How did your experience with the (HEP) impact your views of engineering and community service?*[6] | "...reinforced my views… I chose to go to _____ because of the (HE) Center… backed up the idea that I need to serve other people and I can use my engineering to do that." | "Back to the ***military***, I've seen engineers just work on stuff that… might be controversial to say… destroyed communities… when I got to see your guys' (HEPs)... that's kind of why I wanted to get into engineering… ***to help***." | While S34 contrasted his experience in the military with his desire to serve through engineering, S17 found stronger connections and seemed to feel ***morally obligated*** to use his engineering for service through the HEP |

*Table 3 (continued): Interview analysis through quotes, summaries, interpretation, and comparison across the two participants.*

| *Interview Question* | **S17 response** | **S34 response** | **Interpretation** |
|---|---|---|---|
| *Can you tell me a bit about your views of diversity or discrimination?* | "I think diversity is definitely important, but, as engineers, I think the most important thing is just helping others | "There's no room for discrimination at all… so many people that were like geniuses and they're not just plain white people, they're people of diverse backgrounds." | S17 seemed to prioritize serving others through engineering over diversity whereas S34 provided a stronger statement against discrimination and bias |
| *Have you had to challenge discriminatory behaviors? What was that like?* | "I would think it's not okay… would not say something right away... maybe after a couple of hours, I would probably go up to them and say something, I think. But I don't think I would do anything in the heat of the moment." | "A lot of times in the army when I was able to, 'cause you can't really have a voice until you hit sergeant level…," also described sexism in the ***military*** | S34 had opportunities to (and did) confront discrimination, but only at certain leadership levels in the military; S17 described a more thoughtful approach to responding to discrimination by taking time to think before speaking up[7] |
| *Why is it hard to speak up?* | His perspective: "I don't like confrontation…" & Referencing others: "they don't want to feel like outside of the group, so they may just ignore it. I think I've probably done that before." | "...I think the biggest hurdle is that people don't want to be a leper in their own social group… they lose friends over a situation... there's so many faults and traps… that's gonna stop people from acting more." | Both discussed ***group dynamics*** and pressure to avoid conflict and isolation as obstacles for people to speak out against discrimination |
| *What encourages you to speak up when you hear/see something discriminatory?* | "Just 'cause it's wrong and people shouldn't talk about other people that way… maybe prevent that in the future." | "I think if I can be at least an example that I didn't stand for it, maybe it might just rub off on other people and I can kind of see things change, at least in my immediate area." | Both mentioned a desire to prevent future instances of discrimination and bias as reasoning for wanting to speak up or act against it |

1. The reasonings for choosing engineering match the diversity of responses shown in [21, 22] Interestingly, S34 seemed to recognize a need for serving others as motivation for choosing engineering which could be related to his age and maturity as posited by [25].
2. Age must be factored in when understanding student veteran experiences as they integrate into college and has been studied in [19, 20], but the authors were unable to find existing literature on age-ism in engineering education.
3. While group dynamics seems to be a strong factor in building relationships among teams, which is supported by a similar study around empathy in [26], these responses seem to go further and emphasize not only physical proximity to one another but also technical tasks or team activities.
4. S17 mentions both the impact of working amongst his team and alongside a partner organization onsite which again match a similar study [26] which references both of these avenues of learning as impactful to developing empathy.
5. Self-selection into HEPs has been discussed and seen as a potential limitation to studies in this field [11, 24]. Interestingly, S17 didn't self-select into HEP because of positive views of DEI, but rather learned to work with diverse groups because of it. Alternatively, S34 had positive views of DEI prior to the HEP experience into which he did not self-select as it was a required course. These contradictions to self-selection bias in HEP studies were also discussed and seen in [3].
6. This question in the interview also referenced the interviewees results from the survey around 'professional connectedness' and 'connectedness' items from the EPRA (see Table 1).
7. Though both participants seemed to want to speak up against discrimination, they mentioned differing obstacles for how and when they were able or felt compelled to speak up. S34 wasn't able to speak up until he reached a certain leadership status within the military, and S17 preferred to avoid immediate confrontation and take a more reflective approach to speak up.

Further building on point 3, the group dynamics including the physical proximity or a joint action seemed to be the most impactful factor for both interviewees. S17 mentioned unique specific actions or physical proximity to his team 7 times in the interview and S34 mentioned 10 impactful instances. In comparison, S34 frequently mentioned teaching other students how to perform new actions like "using power tools" or "figuring out angles" whereas S17 focused more on physical proximity like "playing games" and "long car rides." Expanding on these contrasting experiences, S34 seemed to overcome bias against younger students through these actions whereas S17 seemed to overcome social anxiety as a younger student through close proximity to his teammates. Is it possible that physical proximity and activity among a group dynamic creates a highly impactful experience toward more inclusive behavior? It's also interesting to note the untraditional nature of these two students, their identities, and their experiences. S34, though had multiple identities which are underrepresented in engineering, enacted behaviors toward inclusivity and overcoming bias. On the other hand, S17 who matches a traditionally

overrepresented group in engineering experienced inclusive behaviors from others which improved his experience during and after the HEP. Clearly, the expected results as demonstrated by quantitative studies around engineering and DEI are not exhibited among these two students. Their experiences show that individuals are unique and complex and cannot be simplified to statistical data which further emphasizes the need for qualitative study. These unexpected and somewhat unconventional results leave the authors with more questions yet a deeper desire to better understand the connections between HEPs and views of DEI.

## Conclusions:

This paper, part of a larger study on the connections between HEP and views of DEI, focused on the summary and analysis of two interviews with student participants. The students completed a survey both before and after their involvement with an HEP and were asked to participate in the interviews. The protocol, designed iteratively, included questions about the student's experiences in engineering, their HEP involvement, and their views of DEI. The students were also asked a few questions about their responses in the survey for clarification and deeper understanding.

There was wide variation across the two interviewees with S34 pulling heavily from his experience in the military. The participants had similarities in how often they mentioned group dynamics as impactful to their experience and what they learned from it. Specifically, it seems like physical proximity and completing actions or tasks within the group dynamics were especially important to the interactions and learnings. Additionally, both participants were motivated to speak up against discrimination in order to prevent future instances. Possibly due to the life experiences prior to the HEPs, the participants felt different results from their involvement. S34 overcame feelings of age-ism through working with younger students and S17 gained familiarity and comfort with interacting with older students. These experiences seem contradictory to their identities though - S34 as part of multiple underrepresented groups (traditionally desiring inclusion) and S17 as a part of a majority group (traditionally overcoming bias). Clearly, understanding the experiences of a single individual changes perceptions of what we might expect from groups and can shatter stereotypes. The authors are excited to build on this work through further interviews with engineering students and alumni of Lipscomb with continued thematic analysis.

From this study, the authors will build a model for creating inclusive engineers through humanitarian engineering projects. The model will be disseminated to a broad audience of engineering educators, practitioners, companies, and organizations with the intention of building engineering workplaces that are inclusive and equitable to then increase diversity in the field.

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