Practicing care in global engineering with underserved communities

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Abstract

This paper describes the inclusion of care as the central part of an undergraduate engineering course that brings together engineering students with underserved communities globally. It begins with a brief description of the course, its aims, and the unique approach it pioneers of students working *with* the community rather than *for* them. The class project focused on improving sanitation and hygiene problems in rural India was undertaken in groups of three. It then describes the challenges of ensuring participation of the students and the community as equal partners and how this was achieved by including practice of care as a central piece of the course. In addition to reading and discussing literature on care ethics, the students used these concepts to create individual "care statements" which guided the design process. The paper then describes a preliminary attempt at understanding student engineers' experiences of engaging with care as well as their evolving understanding of practicing care in engineering practice.

Introduction

Uplifting the poorest, most marginalized communities in the world is one of the most pressing challenges we face. The creation of a sustainable prosperity requires that communities can participate in the societies and institutions that surround them, while also preserving their unique identity. One approach pioneered by the Kozmetsky Global Collaboratory (KGC) at Stanford University starts by fostering long-term collaborations between these marginalized communities and the scholars and students who want to work with them. The reasoning behind this approach is that it takes time to understand the nuanced nature of the problem as experienced by underserved communities and appreciate the complex web of social, economic, political and cultural that the community is embedded in. This approach is in keeping with the KGC mission of creating "shareable prosperity" that "seeks to mobilize knowledge to serve men, women, and children living in extremely impoverished conditions through active collaboration with those people. And it seeks to do this in ways that build bases for sustained inquiry by those men, women and children." It can be best achieved through the "practice of ethics of care"[1].

The Global Engineers' Education (GEE) course that served as the research setting for this paper is founded on a decade of work at the KGC at Stanford University aimed at fundamentally understanding the nature of challenges we face in creating shareable prosperity and on developing methods for applying research insights in actual field conditions. In particular, GEE builds on a dissertation of a KGC scholar in the Mechanical Engineering department at Stanford University that developed a novel approach for student engineers to collaborate with underserved communities.

GEE and the *working with* approach

Engineering for underserved communities has largely followed a one-sided approach. This approach focuses on the transfer of technology[2] and frequently imposes solutions that have proved successful in prosperous countries but fail to have the desired impact on impoverished communities. Local conditions, both environmental and cultural, have an impact on the solutions and their efficacy. Attempts to solve problems that do not incorporate local support and take into account the aspirations of the local community do not sustain. They last as long as outsiders (NGOs, researchers or governmental agencies) are present in the field. When they leave the ongoing attempts to address the community's problems come to a complete stop usually because they are not representative of the local community's aspiration for their future[3, 4].

The GEE course provides student engineers with the opportunity and training to collaborate with a community in rural India to develop solutions to sanitation and hygiene challenges. The KGC and the author have been working with the field site for four years and have established trust with the community partners with the shared intent of establishing long-term, collaborative, research based, community interventions and development.

The GEE curriculum teaches engineering students to design products and services *with* impoverished communities, rather than for them, and consider how these products and services can contribute to building a sustainable local economy. GEE blurs the distinction between the student engineers in their role as solution providers and the underserved community in their role as consumers of the engineering solution. In doing so lies the opportunity for manifesting something together with ingenuity and creativity.

The course brings together readings from several disciplines to enable students to understand the complexity of the problem space. Field experts and members of the community are invited as guest speakers to the class via Skype to provide local context and know-how. The community members share their experiences, their ideas on possible solutions, the local context as well as provide input and feedback on the solutions that the students come up with. They have also in the past built prototypes of ideas that the students have come up with and undertaken costing and testing to give more detailed feedback and suggesting improvements to the design. Finally, the course employs "care" as a means of navigating the problem space and engaging with the community as equals. A more detailed description of the curricular features of GEE can be found in a previously published paper [5].

Each student composes a personal care statement that communicates his or her care about the problem of sanitation and hygiene in the community. This allows students to shape their perspectives and priorities as they engage in a design process modified from the Stanford Design Process. This becomes a method. Through their care statements, students are able to carefully create engineer solutions in close collaboration with the community.

The main features of the *working with* approach are summarized in the table below.

Features of *working with*	Implementation in GEE

Collaboration with underserved community	Regular Skype calls with Community partners
Understanding the complexity of the problem space	Readings from multiple fields including gender studies, philosophy, economics, sociology
Equality of engagement by students and field partners	Articulation of *what I care about* and employing a discourse on care
Active reflection	Journaling and reflection papers on class readings

Table 1: Summary of the *working with* approach and

The focus of this paper is on the role of care and its practice in the working *with* approach. It is followed by discussing the experience of the GEE students in grappling with care and the ethics of working with underserved communities.

The role of care in GEE

The current offering of the GEE course brings together undergraduate engineering students at Stanford University with an underserved community in India to address the challenge of sanitation and hygiene. The collaboration is therefore attempting to reconcile social, cultural, economic, political, linguistic and geographical differences. By enabling regular communication with suitable translation, the student engineers and the underserved communities are able to experience the realities, knowledge, expertise and aspiration that they have for themselves and for one another.

The aim of the *working with* approach is to transcend the barriers imposed by the conventional definition of designer and consumer. In fact, in this case, the experience of creating solutions together requires that the underserved community members become designers and architects of the solution and the engineering students become consumers.

To put the *working with* approach into practice, students were asked to reflect on *what they care about* within the current problem space. Care has been described as relational, interconnected[6], as requiring contribution from both the caregiver and the benefactor of care[7], and as having at its roots a shared sense of living well[8]. Caring has been described as recognizing the integrity of others and engaging in mutual learning[9]. These characteristics of care and caring made it a natural fit for the *working with* approach. In addition to discussing what care means and how it has been described in literature, students were asked to arrive at their own individual *care statements*. In doing so, they were able to apply the concepts of care and caring themselves and arrive at an articulation that enables them to put their care into practice.

In addition to developing individual care statements, the students were requested to ensure that their individual care statements and the care statements of the community participants must all be included as requirements for the final design. There will be no prioritization of care; neither will there be any attempt to arrive at a care statement by consensus or democracy. Instead the tensions of competing (or conflicting) care

statements must creatively create a final solution responds to everyone's care. This direction was given to ensure integrity of the *working with* approach and to prevent the students from acquiescing to the communities' needs and to prevent the community from accepting student design ideas without question, critique and input. This is reflected in Mayeroff's description of caring, "Direction that comes from the growth of the other should not be confused with being "other directed", where this refers to the kind of conformity in which I lose touch with both myself and the other."[9, pp. 5]

Student experience of GEE

The GEE is an application based class capped at 15 and open to all undergraduate engineering students. A total of 11 students (1 senior, 6 sophomores and 4 freshman) took the course in the spring quarter of 2014. As part of the course, students were required to maintain a reflection journal. A total of 269 journal entries were collected to reflect the student experience of the course. The student journals spoke of the students ever-growing awareness of the complexity of the problem space. What had initially appeared as a problem of building new or improving old toilets suddenly became a not so obvious question of cultural norms and taboos. The toilet transcended from a mere technological artifact to a symbol of gender equality, dignity and safety. "*I thought the readings lately have been very eye-opening. I mean they all are, but some like the "Ladies and Gents" and "Geographies of Danger" provided perspectives surrounding toilets and culture that I never thought of before. There's much more to the toilet than I know!*" [Student 1014]

Responding to a paper titled Engineering to Help (ETH) [10] a student wrote, "*Engineers are not hermits who solve problems in isolation. Indeed, design philosophy itself requires that designers empathize with their target audience before they start to ideate; only then will they feel a real motivation to develop a solution. But empathizing with nail-polish users is relatively easy, compared to empathizing with underserved communities in Third-World countries scattered around the world. While the authors, like us, see this as a challenge which must be surmounted, I was left wondering how they would expect engineers in ETH programs to go about appreciating each "underdeveloped" country's historical and cultural context for development. I would ask them about what examples, if any, they have seen of "good" ETH and "bad" ETH. With this information, engineers in ETH programs (like us) would have a benchmark for our own actions.*"[Student 114].

Others started looking into the ethical challenges of working with conflicting needs of various groups within the underserved community. "*But what if the conflicting needs come from separate factions within the community? In discussing cultural and social factors, one may fall into the trap of thinking a village contains a homogenous culture or set of values. How can we comply with a community's requirements if it is steeped in masculine identities that may bring harm to women? How do we navigate "working with" a community when members of the community may not have each other's' best interests at heart? Where do we draw the line in prioritizing one group's wants over another's?*"[Student 814]. "In particular, I really enjoyed discussing the inherent flaws of human-centered design. Solutions to problems necessarily cater to the desires of the end-users of the product. But what if the desires of the end-users are unethical, or

otherwise problematic? How can engineers collaborate with a community whose desires counter the engineers' moral intuition?" [Student 614].

Many of the students articulated feelings of taking things for granted and the shock of how different their experiences were from that of underserved communities. "*I was very taken back by the Geographies of Danger [11] paper, in which issues of girls specifically facing the danger of rape when going to the bathroom in sub-Saharan Africa. This was extremely alarming for me, as safety has never been an issue that I would consider when going to the bathroom. It's sometimes hard to hear how that a community lacks things I take for granted on a daily basis.*" [Student 914] "*This* [Geographies of Danger] *was definitely a more challenging reading for me to get through compared to the others due to the heartbreaking subject matter...I had no idea that even when toilets were located on school campuses themselves, girls often felt unsafe near them. I understand that toilet is remote areas are never a good idea for the safety of young and old women. However, I had never once asked myself the question- who will be enforcing/ensuring that the toilet is being used as we intend it to be used?*" [Student 1114]. "I*t makes me wonder: who am I to even think I can work with poverty? It feels humbling, and also sobering. There's so much I don't understand because I've grown up never worrying about affording food or shelter or school. Not even thinking about traditional culture, there's so much deep listening I need to do to understand what it means to grow up in a different culture surrounding agency.*" [Student 714]

Towards the end of the quarter though, most students wrote that they had found some clarity on how work with underserved communities globally. "*One of the questions* [in the Engineering to Help paper] *was to ask oneself how one's lifestyle or institutions he/she are a part of contribute to greater disparities that may be causing the problems they are addressing.* [The Instructor] *said that she encourages students to stop asking themselves a question if it becomes paralyzing and only ask questions that motivate them or make them proactive. I really like the idea of this approach, as it makes it possible to stay focused and working towards some change or progress, rather than merely spiraling in a circle of guilt. I've personally really enjoyed this class, as I often feel like I learn a lot of facts that make me feel guilty and am never sure how to act, but haven't felt this as much in this course.*" [Student 914]. "*I really enjoyed the fact that we were thrown into the HUGE problem of sanitation, maybe complex is a better word. Being humble and knowing what you don't know is key, but if we're never willing to enter the realm of things we do not yet understand, we'll never learn. I've learned that sometimes this is the only way to really attack a problem is to have no fear and dive in.*" [Student 1114]. ""*I'd rather inspire you to action. Ask questions that actually get you to act. You'll find that much more empowering." BIG THOUGHT I DEFINITELY LEARNED THE HARD WAY: If asking questions paralyses you, ask a different question. :)*" "*As I reflect, I think about not just my monstrous material privilege, but also the privilege of the world-view and self-view that comes with it. I'm excited to explore and see how what I've been given, materially, academically, and culturally, can be used to expand others' "capacity to aspire," but also feel sobered as I delve into how I might and should relate and connect and listen best to other cultures.*" [Student 714]

Student experience of care

The primary aim of this paper was to examine how students could put care into practice as a means of engaging with the ethical challenges that are inherent in working with underserved communities globally. To that end, the student journals were carefully read for mentions of care. Quotes that spoke about care, care statements and caring were noted. The quotes were then re-read and quotes reflecting a common theme were grouped together. What follows is a description of three major themes that stood out.

Care vs. responsibility: One of the papers the students read as part of the course was Christopher Groves' Future ethics. Upon reading this paper several students reflected on the difference between care and responsibility. *"While I understand the nuances between their definitions – when you care for a community, it is the action that motivates you, but when you feel responsible, it is the result that motivates you – I find the two to be very related to each other. Although perhaps I am just inexperienced with social work, but I get the inclination to believe that when I care for a community, I am also going to feel responsible for them in a way that is intrinsically linked to 'caring.' For example, although I may have good intentions with my actions, if I do not take into the account the impact I am leaving on the community, I may actually be harming more than helping. Funny, after I wrote this journal I feel like I now understand why care and responsibility are separate things. Related? Yes. Often present at the same time? Of course. But the same thing? Nope."* [Student 514]. Other students reflected more directly on the difference between care and responsibility as applicable to the work at hand. *"Caring is a much stronger motivator than responsibility and, therefore, I think that our team should be much more aware on solving something that we care about rather than what we feel responsible for… I think that the idea that care is about action and is motivated by emotion is very important, especially to this project and class. It can be difficult to feel responsible to design a toilet or sanitation system for people I have never met in a place where I have never been, but I think that identifying a more emotional motivator will make the class feel less like a project in a class and more like something that I want to do."* [Student 314].

Care and the *working with* approach: Students reflected on how bringing their own care into the design process was different from what they had done before. *"I feel like the biggest thing I learned is that the designing process should not just be designing for someone else but it is okay to combine what you care about with what they care about. By doing that I feel like you are able to create much more so a relationship of mutual trust to reach a common goal."* [Students 414] Others felt similarly and wrote, *"[y]ou are not a savior. You don't just go in and "help" people. You work with them. You grow with them, learn from them, alongside them. The line of consumer and designer disintegrates."* [Student 714]. One student however, struggled with imposing her care as a requirement saying, *"The idea of bringing what we ourselves care about into the design equation is interesting. It begs the question, how do we insert our own values and cares into the process without trampling over our Indian partners'. Is there/should there be a hierarchy of whose values come first? It seems to usually be the needs of the people we design for. So in working with, are everybody's cares/values on the same level? Shouldn't the*

criteria of the people using the toilet (or the people who at least have full understanding of the cultural, religious, socioeconomic attitudes) weigh more, or is this just residual of the working for approach?" [Student 614]

Care in addressing the problem: Several students at different points in the quarter reflected on how to use their care/care statements and how that affected them and their ability to come up with a solution to the challenge of sanitation and hygiene faced by their community partners. Student 814 wrote, *"my personal care statement became developed a bit when I did bathroom clean on Sunday night (4/20/14). I thought it was a little gross but I realized there were so many aspects of sanitation that we are shielded from. The thought of my dorm's feces collecting in a pit— and then being tasked with cleaning that is unimaginable to me."* Others found it quite hard to determine their care statements. *"I care about physical, emotional and mental health, education, equality, respect, etc. Identifying 1 or 2 major things that I care about for this project will be difficult for me, as I care about so many things."* [Student 914]. Student 314 noted early on in the quarter, *"I think that pinpointing my cares will motivate me and be beneficial for myself, my team, our class, and the community in India".* Just after the middle of the quarter she wrote, *"I think that it was important to remember that all of us have different cares and we must work together to ensure that all of our cares are thought of while brainstorming, ideating, and prototyping. I think that our differences in views and perspectives is helpful in working toward a prototype that can improve the user experience, help to change behavior of the people, be energy efficient, and be of a sound design."* When designs for the mid-quarter check-in were due, Student 1014 wrote, *"I plan on filling out my full care statement very soon, as I had one in mind until Monday's lecture. I had this mindset that it's week 5, we need to settle on an idea… It did make me think, however, that it's okay to not finish if I've done all I can with what I care about. I shouldn't choose to design something just because it seems doable for this last stretch of the quarter."* Student 514 notes towards the end of the course that, *"By really acting upon what you care about, you are indeed finding an innovative space in which you are helping both yourself and helping others."*

 GEE and the practice of care

The GEE course is unique in providing students with a context where they are able to encounter most of the complexity and immediacy of the problem space safely. By collaborating directly with the underserved community and having regular, virtual, face-to-face meetings with them students were very aware of the tensions born of navigating cultural differences. Hearing the accounts of the lives of the communities they were working with was a constant reminder to think about their ethical obligations within the course and in the future.

What GEE provided was a way for the students to move beyond thinking about ethics of working with underserved communities as a concept and instead made it part of the experience. However, instead of simply using the course as an opportunity for the students to confront ethical questions, it offered ways for them to engage with their personal and collective ethical questions by using the discourse of care. What the

preliminary data in this paper reflects is that it became possible for the students to truly collaborate with the community by caring as described by Mayeroff, "In the broad sense, 'being with' characterizes the process of caring itself: in caring for another person we can be said to basically [be] with him in his world, in contrast to simply knowing about him from outside." [9, pp. 32]

Several students mentioned how the use of care had altered their perspective on what to do in the future. *"What I've come to realize is that, for the purpose of this class, it actually does not matter whether or not I care about the sanitation space in India. I can still gain a lot by using this class as an opportunity to collaborate across cultures. I still find the sanitation problem-space fascinating, but I don't see myself investing in it in the long term. That said, I've also discovered what I care about in working on projects in the future. I really like [the field partner's] core values: that is, care comes first, then comes everything else. That set of priorities is something that I will look for in future projects."* [Student 614].

The creation of a care statement forced students to reflect deeply on their motivations for working with underserved communities and what made for ethical interactions. It allowed them to move beyond hypothetical cases and engage with real people, real problems and confront their roles as engineers and citizens to respond to it in ways that would be meaningful. As Student 714 summarized, *"I especially like it because I find it is easy to believe you care about one thing, when in reality your real care has just chosen that as a placeholder because you've yet to pause long enough to identify it. Asking, "what do I really care about?" gets to the heart of our deepest hopes and wants, and brings us to understand ourselves and begin to move in the direction of truth and freedom. I think the cares I have are usually good. But they are good things I have noticed that I've cared about so much that it stopped being about the thing itself, and became about the thing's ability to deeply validate and fulfill me. All that to say what I appreciate so much about asking, "What do you care about?": asking what is most important to us brings clarity by moving from feeling controlled by the desire to help bring a certain change or achieve something, and instead empowers us to align our efforts and move toward doing that thing (or recognize we need to expand our care-circle in order to continue)."*

Conclusion and future work

This paper is a preliminary study of student experience of engaging with underserved communities globally. The GEE course and its requirement for a care statement is one approach to introduce students to the ethical challenges that abound while working with underserved communities in practice in engineering curricula. The experience of working with community partners made the ethical questions real and the care statements served as a navigational tool to arrive at their own personal ethics.

Six former students of the GEE course accompanied the instructor on her field visit to India (where they met the community partners they had previously interacted with via Skype) pursuing research questions consistent with their care statements. Currently, several of these students are using an autoethnographic approach to make meaning of

their own experiences of engaging with underserved communities and what it means to be a global engineer.

Future work will look at the student experiences in more detail and also explore the evolution of care statements and personal ethics among students who continued to engage with the instructor's research beyond the class. The results of which will further investigate the role of care in enabling ethical inquiry within an engineering course.

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