

What Are Crucial Barriers and Opportunities to Bringing Our Whole Selves to Engineering Education? Moving Watermelons Together

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) and Director for the Engineering Plus program. 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 students learned 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. Jon A. Leydens, Colorado School of Mines

Jon A. Leydens is Professor of Engineering Education Research in the Division of Humanities, Arts, and Social Sciences at the Colorado School of Mines, USA. Dr. Leydens' research and teaching interests are in engineering education, communication, and social justice. Dr. Leydens is author or co-author of 40 peer-reviewed papers, co-author of *Engineering and Sustainable Community Development* (Morgan and Claypool, 2010), and editor of *Sociotechnical Communication in Engineering* (Routledge, 2014). In 2016, Dr. Leydens won the Exemplar in Engineering Ethics Education Award from the National Academy of Engineering, along with CSM colleagues Juan C. Lucena and Kathryn Johnson, for a cross-disciplinary suite of courses that enact macroethics by making social justice visible in engineering education. In 2017, he and two co-authors won the Best Paper Award in the Minorities in Engineering Division at the American Society for Engineering Education annual conference. Dr. Leydens' recent research, with co-author Juan C. Lucena, focused on rendering visible the social justice dimensions inherent in three components of the engineering curriculum—in engineering sciences, engineering design, and humanities and social science courses; that work resulted in *Engineering Justice: Transforming Engineering Education and Practice* (Wiley-IEEE Press, 2018). His current research grant project explores how to foster and assess sociotechnical thinking in engineering science and design courses.

Dr. Ann D. Christy P.E., The Ohio State University

Ann D. Christy, PE, is a professor of Food, Agricultural, and Biological Engineering and a professor of Engineering Education at the Ohio State University (OSU). She earned both her B.S. in agricultural engineering and M.S. in biomedical engineering at OSU, and her Ph.D. in environmental engineering at Clemson University. She worked for an engineering consulting firm before entering academia and continues to collaborate with the consulting industry. She has taught courses in bioenergy, biological engineering, capstone design, HVAC, thermodynamics, waste management, professional development, and engineering teaching. Her research interests include energy, the environment, and engineering education. She is assistant dean for teaching and learning in the College of Engineering. She is a second-generation woman engineer.

Dr. Marybeth Lima P.E., Louisiana State University and A&M College

Marybeth is Cliff & Nancy Spanier Alumni Professor and Chair of the Department of Biological & Agricultural Engineering. She co-authored the textbook *Service-Learning: Engineering in Your Community* (Oxford University Press) with Bill Oakes and is the author of *Building Playgrounds Engaging Communities: Creating Safe and Happy Places for Children* (LSU Press).

Dr. Malini Natarajarathinam, Texas A&M University

Dr. Malini Natarajarathinam joined the faculty of Industrial Distribution Program at Texas A&M University in 2007. Natarajarathinam received her Ph.D. in Supply Chain Management from The University of Alabama. She received her Bachelor of Engineering (Major: Industrial and Systems Engineering) from

Anna University [Tamilnadu, India], her MS in Industrial Engineering from Auburn University, her MA in Management Science and MS in Applied Statistics from The University of Alabama. She has experience working with many industries such as automotive, chemical distribution etc. on transportation and operations management projects. She works extensively with food banks and food pantries on supply chain management and logistics focused initiatives. Her graduate and undergraduate students are integral part of her service-learning based logistics classes.

She teaches courses in strategic relationships among industrial distributors and distribution logistics. Her recent research focuses on engineering education and learning sciences with a focus on how to engage students better to prepare their minds for the future. Her other research interests include empirical studies to assess impact of good supply chain practices such as coordinated decision making in stochastic supply chains, handling supply chains during times of crisis and optimizing global supply chains on the financial health of a company. She has published her research in Journal of Business Logistics, International Journal of Physical Distribution and Logistics Management and peer-reviewed proceedings of the American Society for Engineering Education.

Dr. Julia D. Thompson, University of San Francisco

r. Julia Thompson is an Assistant Professor at University of San Francisco. She has a passion for integrating the soul's work into the engineering design process and technology. She is driven to help students, and people in general, look at technology as a pathway toward healing of earth and unjust social structure. Julia did her undergrad in chemical engineering at UC Berkeley and her PhD in engineering education at Purdue. Her research interests focus on how engineering design practices impact the relationships that engineering programs create with the community.

What are Crucial Barriers and Opportunities to Bringing Our Whole Selves to Engineering Education? Moving Watermelons Together

“MAYA ANGELOU: You only are free when you realize you belong no place — you belong every place — no place at all. The price is high. The reward is great...

BILL MOYERS: Do you belong anywhere?

MAYA ANGELOU: I haven't yet.

BILL MOYERS: Do you belong to anyone?

MAYA ANGELOU: More and more... I belong to myself. I'm very proud of that. I am very concerned about how I look at Maya. I like Maya very much [1].”

“Not being different in America can lull you, can cripple you – even though it seems desirable to everyone, even though everything in the society pressures you into sameness – it is a handicap in the end. A handicap to live without knowing the struggle of difference – in all of its pain, its fear, its celebration, its compassion [2].”

Abstract

This is an archival record of a proposed panel discussion for the 2021 ASEE Annual Conference and Exposition. It reflects a year-long conversation between the six co-authors. Panel attendees will be invited to join and expand upon that conversation. Further analyses and integration are planned after the conference when we will have the benefit of other panel attendees' comments and their own narratives.

Under ideal circumstances, engineering cultures in academia and industry bring out the best in people, e.g., faculty, students, and administrators in academia, and employees, clients, and public stakeholders in industry. Bringing out our best performances increases career satisfaction and productivity. Yet we also recognize that the engineering education and industry cultures we inhabit often fall (far) short of that ideal.

Many of us in engineering education are working towards the transformation and healing of the engineering profession and engineering education cultures – while individually striving to be more authentically ourselves. We recognize that our inner work is directly linked to our outer

community. This panel represents the collective thinking of a group of six engineering educators in different paths and stages in our careers. We come together to discuss how we, with your help, might move engineering education and the engineering profession in a more humanitarian, soul-fulfilling direction. We recognize the task in front of us is massive. Think of it as moving a pile of watermelons a few kilometers. The movement towards transformation requires all of us to stand up and take a share. However, we must also recognize our personal limitations – we cannot hold too many watermelons and expect to move forward. We need to come together and balance the load.

This panel session will begin with panelists briefly describing how, in their own journeys, they encountered barriers and/or opportunities to bringing their whole self to engineering education. The panel will then move into what we hope is a lively discussion among audience participants around the following queries:

- What are the *barriers* to bringing your whole self to your work?
- What *opportunities* can help you bring your whole self to your work?
- If you are able to bring your whole self to your work, what does that look like for you?
- What principles of inclusion and healing might facilitate a cultural transformation in engineering education and the engineering profession?
- What could be possible?

Our Framing Question and the Narrative behind the Framing Question

This group of six co-author panelists from a variety of different institutions and departments started meeting through an invitation from one of the co-authors. The original invitation was to contribute to a paper for a community engagement conference that eventually did not happen due to the pandemic. We met anyway for an exploratory conversation. In our first conversation, we discussed the ways we showed up in the world and our career. We agreed to continue the conversation and have brought a few of our reflections into this panel.

The inquiry in this panel is framed by a single question with multiple dimensions: Is it possible to bring our whole selves to our work in engineering education? Each scholar's journey in engineering education has diverse memorable moments, perhaps too numerous to describe, but some of those help characterize why bringing one's whole self to engineering education comes with certain challenges--and opportunities. Inevitably, such narratives are subject to selection and omission, and what we leave in and choose to leave out are both telling. Yet what we leave in tells the tale.

In asking this overarching question, we are continuing a tradition. For instance, members of Engineering, Social Justice and Peace Network have been, since 2004, investigating the diverse constraints and opportunities inherent in bringing one's whole self to one's work in engineering or engineering education [3]. Also, inquiries into one's own lived experiences in engineering education are often discussed by members of this Network with occasional publications [4], [5].

Methods and resources

We are taking an approach of multi-vocal auto-ethnography and narrative inquiry [6, 7, 8]. This approach has been used within engineering education [9], [10], [11], [12], and community engagement scholars have also used narrative methods; examples include faculty narratives [13], student narratives [14], [15], a narrative approach to analyzing interviews with community members and managers [16], and a narrative approach to analyzing transcripts of meetings, interviews, and focus group discussions by community stakeholders and government officials [17].

Narrative has been a powerful source of communal healing and society transformation since the beginning of time. Story is how we learn from each other and make meaning of the world. Through our meetings, we discussed a sense of belonging and ways we felt we did and did not belong in the profession. What follows is a series of individual narratives from the co-authors, describing ways we have striven to bring our whole selves into engineering.

Positionality and acknowledgement of missing perspectives

In this process, it is important to recognize who we are and also who is not here. Out of the six of us, five are women, one is male, one is a woman of color, one was born outside the United States and has a green card, three identify within the LGBTQ spectrum, three identify as straight, all are faculty, one is an assistant professor, five are associate or full professors, and five have engineering degrees. One was a first-generation university student. We all work in engineering contexts at universities across the United States (specifically California, Colorado, Ohio, Louisiana, and Texas), and are associated with community engaged learning within our profession. Five are at R1 universities, one is at a teaching university. We all had different and rich experiences about our initial motivations and family connections to engineering and education in general.

It is also important to recognize the voices who are absent in this conversation. There are not students (undergraduate or graduate), nor are there people of color who were raised in the United States among the original six panelists.

Below are individual narratives by the authors. We each wrote our own narratives in September to October 2020, answering the question: How do we bring our whole or best selves to engineering education? The authors read through each other's stories, commenting for clarity, and identifying themes within and among stories. These were discussed within the group, and we reached consensus on what to include. Some chose to write updates or postscripts to our stories in February to March 2021. The stories and associated themes are a reflection of the authors, and do not represent the whole experience of engineering faculty. Our intention is to support our own search for wholeness within the profession and create some meaning for the reader as well. Since stories are the pathway to meaning, it is our hope that the reader may see and take something out of this via reflections on and (dis)connections with their own journeys in engineering education.

Individual Narratives

(1.) Narrative reflection by Dr. Ann D. Christy, P.E.

“How do I bring my whole self to engineering education?” The first step is the self-awareness to know who that whole self is, and to recognize that my professional and personal selves are one interconnected whole. So, who am I professionally and personally?

Professionally, I am an engineer. I have earned multiple engineering degrees and credentials in agricultural, biomedical, civil, and environmental engineering, working in the engineering consulting industry, and ultimately returning to ag and biological engineering as a faculty member at the Ohio State University. I am a second-generation woman engineer; my mother is an industrial engineer. Her example and training inoculated me against much of the negative societal messaging against women in STEM disciplines.

Personally, I am a loving spouse, sister, daughter, mother, grandmother, friend, and neighbor. I am a spiritual seeker, a board-gamer, an advocate for the developmental disability community, a horsewoman, guitarist, and historical vehicle enthusiast. I am a strong independent female -- maybe because I am gay, maybe because I was raised as the son my father never had, maybe because I binge-watched too many episodes of *Xena Warrior Princess*.

I am a peacemaker who values harmony and brings a calm listening presence. I am good at seeing all sides of issues, at stepping into other people’s shoes, at striving to make sure everyone’s voice is being heard, except sometimes my own. I am an adaptable optimist. I deeply value growth and positive transformation in myself and others, and I believe this is my primary task for this life. On my shadow side, I have a hard time remembering who I am. I avoid conflict to a fault. I can be deeply stubborn when I disagree but am easily silenced by my own sense of not belonging. I have a high inertial tendency -- it can be hard for me to start a project and once started, it’s hard for me to stop, resulting in either procrastination or workaholism or both.

During this time of pandemic forced seclusion, I have felt overwhelmed and depressed. But I have also immersed myself in contemplative practice including daily walks, taking in the works of the mystics and Fr. Richard Rohr, dedicating time to prayer, and continuing to meet monthly (now virtually) with my spiritual director who unfailingly asks me to discern where I see God in my everyday life and challenges me toward further growth and wholeness. I am intentionally seeking out those interconnections that bridge our separate selves and illuminate the reality that we are not all that separate after all. Ultimately your success is my success is our success.

So, how do I bring my whole self, my strengths and my brokenness, to my work? In my work as a faculty member and graduate advisor, I listen deeply to my graduate students and try to help them as they discover who they want to become and what research questions they want to explore. I treat them as junior colleagues by including them in proposal writing and meetings with administrators, and by enthusiastically encouraging them along the way.

In my interactions with people in the workplace, I listen to and value everyone, the custodian as well as the president. However, I admit a bias toward those who hold positions of less power,

whose voices are less likely to be heard. My positionality as a woman, specifically lesbian, engineer who was raised by a woman engineer has afforded me an odd insider / outsider relationship to the engineering profession. I believe there are gifts associated with being an outsider. I also think that solidarity with outsiders, and perhaps even identification as an outsider, is what makes authentic service to the larger community possible.

One of my most difficult professional transitions was leaving the cross-disciplinary collaboration I experienced in the engineering workplace and entering the isolating individualism I encountered upon joining academia as a faculty member. While in my role as senior engineer for a mid-sized environmental consulting firm, I routinely worked on teams of engineers, geologists, and environmental scientists. We each had different ways of thinking and seeing as well as different knowledge bases and skillsets. Each new project was an opportunity to learn more through these close collaborations. Each team had diverse members who all shared the same goal: serving our client through the ethical practice of our professions. The secondary results were tangibles: cleaning up the environment and making enough profit to meet payroll each month. I was unprepared for the very different world and culture of academia.

Many faculty highly praise “critical thinking,” but my experience (especially in faculty P&T meetings) was that this “critical thinking” too often devolved into antagonism and contempt-filled nit-picking that fed perpetrators’ egos and enforced their targets’ sense of separation and not belonging. I did not initially understand nor feel intrinsically motivated to seek the reputational laurels by which academics chose to judge one another. Thanks to my industry experience and family history, my identity as an engineer was never shaken, but I often questioned whether I belonged as a university faculty member.

Although I may have doubted my own belonging as a faculty member, I never doubted my students’ belonging as engineering students or as future engineering professionals. As a classroom instructor, I take the time to introduce myself and have each student introduce themselves. I try to really listen, to mirror back, and affirm that they belong here. I try to share the professional and personal skills that will help them succeed as engineers and as human beings. I desire the highest and best for every one of my students. This includes seeing the spark of divinity and of greatness in each of them. This includes setting high standards and then equipping students to meet and exceed them. I see it as my job to help prepare these young adults for success in the first half of their lives, but also to let them know there is more to be discovered in the second half (and not to get stuck in a first-half-of-life achievement-junkie trap). I believe in my students even when they may not believe in themselves, having compassion for them as they struggle with difficult course materials and tough life decisions. How do I bring my whole self to my work? I think it is ultimately about love.

(2.) Narrative Reflection by Dr. Malini Natarajarathinam

How do I bring my whole self to work?

Not Typical - The Typical me!

Personally, and professionally, I have always felt like I was not like the others. I, at most times, was not typical of people around me and did not do what was typically expected of me to be

doing. Growing up in a small village in India wanting to go to college and be a professional was not typical. Attending the local school and being part of English drama events locally was not typical. Majoring in Industrial Engineering in college was not typical when the majority of the students would want to major in traditional engineering disciplines. Flying to the US from our small town (of course, with multiple transfers) to pursue a graduate degree was not typical. Starting grad school with a full graduate assistantship was not typical. Working on a Master's thesis was not typical. Graduating from a Master's degree program saying that I would never go back to school was not typical. Getting recruited to pursue a doctoral degree was not typical. Finishing up a doctoral degree with experiences working as a teaching assistant, research assistant, project consultant, and an intern was not typical. Joining an industrial distribution program (ID) was not typical, especially when there are no programs in the U.S. that focus on business-to-business (B2B) supply chains specifically. Being the first female tenure track faculty in ID was not typical. Getting excited for football Saturdays was not typical. Identifying alternative work accommodations for my maternity leave when my department had done this only once before, more than 16 years ago, was not typical. Being able to submit my tenure package the same month I was due to deliver my first child was not typical. Despite the wealth of new knowledge that gets created in my institution, coming to the realization that even the simplest contributions have not reached many individuals and organizations was not typical. Understanding that the best solution to the problem is the solution that people can actually use is not typical. Figuring out the need to develop solutions for all and not just solutions for some is not typical. Engaging my students with service-learning projects focusing on increasing the efficiency of emergency food assistance providers and hence, their impact on their local communities was not typical. Moving the focus of my research from operations management to community engagement and education was not typical.

Perspective from Exploring Other Interesting Molds

However, I never viewed being not typical as being different or unique or special or weird or gifted. Never was there a time where I did not feel like I did not fit the mold. I most certainly did. However, I loved to peek outside of my mold to see other interesting molds. That, I believe, helped me develop perspective. Those made me appreciate the molds I had and respect the other molds that existed. All the peeking and trespassing helped me be more flexible within my mold.

All these attributes of mine made it challenging for me to prove my value to others. Because my value and contributions were not typical, I had the additional responsibility of promoting and highlighting my impact and effectiveness constantly. Some get it and most don't. It is not an impossible journey, but one that could be exhausting at times. All these experiences still make me me, and I had to understand that this might be the same for others.

The Value and Power of a Network

This led me to understand that I need a network that would understand me and appreciate me. However, that network is not going to be made of people who that are just like me. I came to the understanding that these people would also be people in a mold but would have had their fair share of dabbling and dipping in the other molds. This was and is the most important strength that helps me bring my whole self at all times. I had to understand that there is not going to be one person who is going to understand all the various perspectives and dimensions of me, and I needed to be OK with that. I had to look for many people who had little pieces of me present in them or reflected in them. I actively sought those people. Interactions with people who are also

not typical in their own little but unique way gives me hope and strength. These people energize and help me progress. Going forward was not easy but when I know there is someone who is also taking a step just like I am makes it bearable. Even enjoyable. I have also come to understand that I should not expect that the same person would understand me and help me take all steps of the journey. However, there might be a different person for each step, and that is typical.

Believing in Self and Valuing Contributions

The other important thing that helps me be my whole self is to believe in me and the value that I create. If for one second, I did not believe them or doubt them, I would have to question all my effort, struggles and my entire being. Believing in myself and the people who saw me are the two main things that have helped me so far. They have given me the freedom and sometimes permission to pursue the things I like to do and I want to do - Just the things that typically one might not do.

(3.) Narrative reflection by Dr. Marybeth Lima, P.E. (September 22, 2020)

“You don’t owe the person who gave you the opportunity; you owe the person who comes after you to pay it forward. We’re all links in that long chain [18].”

I think that the answer to how to bring my best self to my work is still evolving, even after all this time! Perhaps it’s because I am still evolving (which I think is good)—but even so, sometimes, I can still be surprised, even on things I feel pretty settled on.

For example, I would have told you up until three years ago that I do my best work (from a writing/creativity standpoint anyway) by holing up in my home office, with at least a 5-hour long open block of time. This approach works for me because there are no distractions: no people; greenery and birds out my window (helps creativity); everything I could want creature comfort-wise within a short walking distance (food, water, bathroom, etc.); low stress (no deadlines on top of me or things people need me to do in the short term, etc.). It’s the whole “Air and Light and Time and Space,” Helen Sword [19] writes about, where academics always wish, “If I had air and light and time and space to write/create, all would be well....” (I highly recommend the book for a great perspective on this sentiment).

Then came my friend and LSU colleague Irina... most of this above is still true about doing my best writing/creating from an environmental standpoint, but I have found that I can work with someone nearby (in the next room, i.e., working in parallel). I think the key for me is that the person holds a similar passion for discovery and creativity (can bounce ideas off of) and the ability to “sit and go” in a work groove, similar to the way I do. This experience has been great for me, generally once a week—moving back and forth seamlessly between “flow in parallel” and then during breaks, trading thoughts and ideas, which sometimes leads to things we create together, and which results in more energy/ideas for more “flow in parallel” again.

I’ve struggled with pieces of COVID-19. I also recognize that there are gifts from this situation (though to date, there have not felt like many). COVID has made me realize that there are lots of optimization points. I can overdo it on home office (i.e., lack of significant face-to-face (F2F)

interaction with my team and my peers and my people is detrimental—I feel slow and stuck). It's also been good to know! I also like travel more than I thought (I just did too much of it pre-COVID—I didn't really realize that there was an optimal point, or at least, I hadn't experienced not enough of it for a very, very long time).

If I consider all these continuum scales, they probably fit together in some higher dimension (personal response surface methodology?), but if you take them separately and have a too low and too high on either end and optimal somewhere in the middle and you graph them, the coronavirus pandemic has made me realize that things are not exactly where I thought they were. And more self-knowledge is always better, IMHO (in my humble opinion).

I am going stream of consciousness with this thing—if I look back at what I've written so far, it's been a little about how I do my best creating in terms of environment and the fact that COVID has made me consider different aspects of my life differently.

In addition to creative environment, there are also personal factors and the profession itself.

Briefly,

(1) What helps me bring my best:

- It (the work) HAS TO MATTER—I feel like my work must have a greater purpose, i.e., to make things more fair, just, and accessible. I think I have lived with a sense of restlessness (there's probably a better term) for most of my life—this sense was not a good thing for me when I turned it inward (and I did in high school and college)—but effectively turned outward (which I learned to do somewhere in grad school at Ohio State), it allows me to “Fall down 7 times, get up 8” (Japanese proverb), and in the words of my father, to “Give it hell, Mar.” I feel like I do that, pretty much every day, in what I hope will someday amount to more just systems, whether it is using engineering to help facilitate community well-being, or to make the profession more accessible for people. I get frustrated sometimes because I feel like I can't get enough done or work hard enough, while other times, I feel overwhelmed. Sometimes I say, “I've got the CRIT” (an acronym that stands for COVID: not literally, but the general malaise of it from so much changed about life and so many sick/dead; Racial Injustice; and Trump)—that too feels overwhelming. But I'm still “hacking away,” even if I'm slower and I don't have quite as much joy as usual.

- Speaking of joy, that's another thing that helps me bring my best self to my work. I feel privileged to have joy. I have a wife who loves me and encourages me in everything I do. She challenges me to be better, to be ethical, to broaden participation, etc. (She is a director of special education; all about equity, accessibility and fairness—she is a model). She is my rock—I can dance with my rock and even on my rock, i.e., metaphorically standing on her shoulders helps me reach for the sky. If I'm a tree, she's the soil and nutrients around the base, while the positive energy/environment of others is the ether.

(2) What hurts/hinders me from bringing my best:

- Thinking around “success” and what that looks like (Einstein is attributed to have said, and it's one of my favorite quotes: “Not everything that counts can be counted, and not everything

that can be counted counts”—I need to remind myself of that—it is hard to shake the inculcation of what matters to a faculty member to get tenure and then get promoted).

- Is it about dollars and refereed journal articles and citation counts or about justice, equity and fairness? (Can it be about both?)
 - Is it about the university’s 6-year graduation rate or the students who “don’t count” in that metric because they took 7 or more years but WHO MATTER? And whose difficulties were in part due to systemic issues?
- Stress—when I feel like someone is counting on me and I am letting them down if I don’t get it done.
- When there is so much to do that I feel like I am running around putting out fires and thus unable to be mindful (quadrant two of time management: high urgency, low impact).
 - I have a hard time saying no to students and I tend to take time to help people out/facilitate their success, and it takes a lot of my time. This work is intentional and doesn’t show up on “a counter,” but matters to me heart and soul. I do this work as a journal editor (instead of rejecting the paper that you “ought to” as an editor, you work closely with the assistant professor to make the paper better in many successive iterations to get them there). As a mentor. As a teacher. As a colleague and friend. But the time input takes a toll. I have insomnia sometimes (do I figure out how to fall asleep or do I just get up and work?). These things stop me from being my best (past optimal). But I am not sure how to not do it. What do you drop?

Postscript (February 21, 2021)

I just finished reading what I had written five months ago on “how to bring my best self to my work.” Not much has changed about my personal thoughts, but the general ecosystem, for me, has changed significantly in two ways. First, there’s no more CRIT (now it’s CRI)—I no longer feel stymied in the ways I was five months ago (the Trump presidency and its tendency to lurch us from crisis to crisis, along with its full-blown assault on many things I hold dear, including democracy, justice, inclusion, and equality, the environment, and even birds, really impacted me personally. Now that his presidency is over, I feel so much better, though aware of the immense work we need to do as a society). The second significant change is my job. I finished the previous version of my essay two days before a phone conversation that resulted in my making the decision to apply to serve as the next chair of my department. That process played out over a few months, and I am now three weeks into this new position.

Rather than writing about how this feels at the moment (and perhaps I should in another forum, I could write reams on it), in the context of bringing my best self to my work, I am moving forward with the knowledge that the reason that I wanted this job was because of CRIT/CRI—at least for me, part of the process of living has been knowing that there are “seasons,” in terms of times to reflect/take stock, and times to act. 2020 made me reflect and take stock in ways I hadn’t before and truly made me double down on inclusion—my decision to run for chair was about taking our department, which does what I consider a fairly decent job with providing an inclusive environment, and facilitating a process to make it more inclusive. I was forthright with this idea during my interview and hired, whether because of it or despite it, I am not sure, but I feel poised

to act. A huge part of my agenda is going to be asking the various constituents of the department these questions: How do you bring your best self to your work? How can our department help you get there?

(4.) Narrative Reflection by Dr. Angela R. Bielefeldt, P.E.

Thoughts on Best Self (October 2020, edited March 1, 2021)

I am actually finding it very challenging, recently, to bring my best self to my work. I am not in a good place mentally - all of the stresses of COVID and racism issues; my daughter at home for 'online learning'; my husband working from home since March. And as usual far too much going on at work.

So, bringing my best self starts with being in a good space mentally. The overall balance of my life as a whole.

My best self has the time for curiosity, and forgives myself and others for lack of perfection. "Maintaining "high expectations for the life trajectories of all [] students and resist acting as gatekeeper[] with students who do not fit easily into comfortable or familiar schemata [20]." I saw this quote in a Patterson and Gray [21] paper I'm reading for an EDUC course that I am auditing this semester; they also paraphrase Winn [20] to "provide learning environments that are empathetic, compassionate, and restorative in nature", which is something to which I aspire as an educator. Patterson and Gray [21] also note the need for teachers to develop the practices of "deep self-analysis." I do believe that I have this perspective on my teaching.

Historically, my work and self appeared to be the same. There wasn't a clear separation, and work-life balance sounded odd because work was almost the entirety of my life during graduate school and my early years as a faculty member. Then when I became married and a mom, my work life and home life seemed to diverge, taking on the feeling of juggling rather than wholeness. This exacerbated the compartmentalization and lack of wholeness I already felt about my work as a professor: research was separate from teaching, which was separate from service. Over my 20+ years in academia, I feel that I have largely succeeded in bringing more wholeness to my work - I research education, so my research and teaching practices converged; service largely revolves around education/educational research (e.g., ABET coordinator) and community engagement. But I still struggle with feelings that my various personal identities are not integrated. So, while I believe that bringing my best self to my work could involve bringing my whole self to my work, I have not yet determined in what way I can actualize that idea.

Reflecting on the idea of bringing my whole self to my job feels somewhat unnatural, an idea that has evolved over time. As an engineering student, I certainly never had the sense that my 'self' mattered in any real way. Good engineering was presented as dispassionate, leaving one's personal issues out of the purely technical endeavor. In fact, it seemed unethical to bring your personal feelings to the job. The idea was work-life balance, where work was separate from life. On the life side you could be a person. On the work side you were an efficient 'machine.' Perhaps the problem began when there was not a balance between work and life. Work took over, and the little time that remained to be "me" was insufficient. So my 'me' started to bleed over into my work. Or perhaps when work aligned with my sense of self those times went

unnoticed, but the times that I had to restrain my personal values and goals drew attention to the lack of wholeness of self that I was bringing to my work. Donna Riley's words distill my ideas in a much more articulate way:

[A] problem lies in engineers' tendency to compartmentalize, to separate... the professional and personal, what it means to act as an engineer versus as a citizen. Yet, engineers are whole people, at once moral beings, citizens (of communities, nations, and planets), with obligations to act out of multiple duties in multiple roles. ...Those of us who work for justice must bring our whole selves to the work, with multiple approaches both instinctual and cerebral. [22]

Belonging (or not) Autobiography

In high school, I thought engineering would be a great place for me to belong. The summer before my senior year of high school I participated in a 6-week summer research program through the Women in Science and Engineering (WISE) program at the University in my hometown. I was matched with a civil engineering faculty member, Prof. AULE. In the lab, I was closely mentored by one of her Master's level graduate students, ANSP. I felt I belonged. These women became my role models and mentors. I continued working with Prof. AULE past the 6-week program - I was hired as an hourly employee for the rest of the summer and worked basically 40-hours per week in the environmental engineering lab. I enjoyed talking with the graduate students. They talked about topics that were interesting. While I never really 'fit in' anywhere in my high school, I finally felt a belonging. I kept working in the lab after school during my senior year of high school. I got a work-release to leave high school campus early for my job. I loved it. I continued working in the lab the summer before college - meeting more wonderful graduate students (PhD and Master's; men and women).

My first inkling of not belonging in engineering was in freshman year of college. As a woman, I didn't fit in engineering. That message came across from faculty and fellow students (campus as a whole was about 30% women; engineering seemed about 10%). As an engineer, I didn't fit in my dorm. I was in an all-women's 'house' (as was common on campus then, that all dorms were single-gender with one or two rare co-ed houses). Luckily, I am an introvert and independent. I studied alone. I was generally able to shrug off sexist comments. The lab and my grad-student colleagues became a refuge. I became recognized as an expert in that domain. My identity was a researcher. Senior year my misfit status was more apparent. My mentor Dr. AULE had left the university. I was aware of her struggles and the sexist nature of our department. When I started as a civil engineering student, there were 4 female faculty members; when I graduated only 1 remained. I never pictured myself as a faculty member - I saw myself in the Master's students who graduated and went into consulting practice. My first summer internship was arranged by ANSP, my first graduate student mentor. So, I was off to graduate school.

Graduate school in environmental engineering at University (Ux) was great. The program was about 50% women. When I visited the campus before choosing to attend Ux I had noticed that about half of the students in the environmental lab were women. It was something that attracted me to the program. So, I fit. I felt a strong sense of belonging. Somewhere along the way my PhD advisor, Dr. DAST, talked me into staying for a PhD. A chance meeting with Prof. MAED

encouraged me to first consider academia instead of consulting and then apply for a faculty position. I didn't know if I would like teaching (I loved research), but thought I would give it a try.

I felt a sense of culture shock becoming a new assistant professor at an R1 university as a 26-year old. I was burnt out from my PhD, having defended and finalized by dissertation in August immediately before coming to Ux. The department didn't seem very welcoming. From the faculty search that hired me, two people were hired - myself and a Hispanic male. The department got an extra faculty line since perhaps we both qualified as 'diversity hires.' Some faculty in the department seemed to resent that. And the resources planned for the position (lab space, funds) were simply cut in half. I felt somewhat alone, and a message of 'sink or swim' was conveyed by the department chair and many faculty. I certainly didn't feel that I belonged. I felt it would be showing weakness to ask for help. Very isolating.

I became angry with my poor ability to teach students - both at myself and at the system that seemed to assume that my research ability would automatically translate into an ability to teach. I also was woefully unprepared for mentoring graduate students in doing research, in writing grants to get money to fund my research, etc. I loved 'doing' research myself (hands-on in the lab, going to the field, etc.). The message from the department and institution was to focus on succeeding in research (starting with getting money), and don't waste too much time or energy on teaching. So, I felt alone in my concerns about my teaching. I was assigned to teach the first-year introduction to civil engineering course my second semester. I felt the weight of the course (helping students transition to college, find their passion, etc.). But the course was 1-credit, and clearly not meant to take up too much of my time or energy. Soon I was also teaching the capstone design course for environmental engineering - another course I felt was critically important in helping students transition out of college and into the profession. Also at tension was the role of the environmental engineering 'group' within civil engineering. A strong 'bottom of the barrel' sort of hierarchy seemed to be in place. Environmental engineering created a new stand-alone degree in collaboration with mechanical and chemical engineering. So, at times our group seemed somewhat 'outside' the civil engineering department.

A significant turning point came when I began engaging in the scholarship of teaching and learning. That was even more unusual within the department. But it provided outside recognition that others valued my education work, an outside community. Each summer I found that attending the ASEE conference was a lifeline for getting re-excited about teaching and connecting with others passionate about the education side of higher education. I had a strong sense of finally 'finding my people.' At last! We would discuss shared passions and shared struggles. Over time this non-Ux community that was committed to engineering education and educational research pulled me farther away from my institution. I developed research collaborations with faculty at other institutions, and I stopped collaborating with faculty in my home department of civil/environmental engineering. Juggling two research areas (environmental engineering and engineering education) was stressful. After narrowly being awarded promotion to full professor despite having "two glasses half full" I finally received advice from our (new) civil engineering department chair to follow my passion. So, I fully committed myself to educational research. I gave up my laboratory space. I have at times

struggled with my new identity - I was once the skilled environmental engineering lab researcher. No longer.

I have been on a journey to learn ‘how people learn’ and how to conduct educational research. I love learning new things, but there is certainly a sense of imposter syndrome at times. I am learning as I go. I cringe to look back at my early ASEE papers - largely Scholarship of Teaching and Learning, but that would be an overstatement as to the scholarly quality of the contributions. I have come pretty far and still have a long way to go. So many people have helped me on my current path. I am grateful to them for their friendship, patience, and inspiration.

March 2021 Reflection

Through our shared meetings over the past months, I have deeply reflected and grown. Each and every co-author in this group has shared insights that have helped me process my path. Certainly there have been key people and moments in my journey to and through engineering. I can see many points when choices were made, and I could now be in a completely different place. I still feel that I struggle every day. I have said ‘yes’ to too many roles, and now most are suffering from my split attention. Frequently I get too focused on ‘doing’ which detracts from my ability to do my best. A recent headline in *Inside Higher Ed* resonated with me: “The Damaging Impact of Unattainable Expectations [23].” I feel that I have unattainable expectations for myself in my roles as a faculty member (research, teaching, service) and as a mother, wife, daughter, and friend. I am mature enough to recognize this but as yet unable to adjust my personal aspirations. My home life that was once ‘cruising’ and enabled me to focus the bulk of my energy on work is really in need of deeper attention. So, every day is a bit of a struggle.

All of the themes we recently discussed as emergent from our stories I have felt, but rarely named: dehumanizing, outsider / misfit, boundary spanning, intentionality, reflective approach, journey. It is hard to conclude given my whirl of thoughts. I hope that this exercise was more than personal catharsis and may be helpful to others in some way.

(5.) Narrative reflection by Dr. Jon A. Leydens

Built to Last—or Discard

“Our minimum time scale consideration when examining a remodel or new construction job is 100 years. We explore the impacts of that design for at least a century, including on surrounding buildings and streets.” The civil engineer who said this to me in 1990 was from Italy, himself a student at the Wall Street Institute of languages in Bologna, where I taught English from 1989-1992. I thought about how much construction in my home country, the U.S., was scrapped after much less than 100 years, with use-and-discard being a common fate for construction. On the campus where I now work, buildings constructed in the 1950s have been demolished. Others built just after the turn of the 20th Century are still standing, and some are fairly energy efficient, even by modern standards. This was one of my first conscious realizations of why engineering decisions matter. But it also acquainted me with the idea that what engineers value shapes what they design, whether something is built to last or be discarded, built to be recyclable or planned for rapid obsolescence; furthermore, what they do not value remains on the periphery, often

never making it into a design, especially given financial and time constraints. So engineering is a value-laden field, no matter how often we tell ourselves and others otherwise.

Floor Study

When I started my career in 1997, insufficient office space led to being placed in a nearby building, just across the hallway from our Geophysics Department. A few weeks after I started there, my spouse asked about my colleagues in Geophysics. In my previous department and university, new faculty generally received a warm welcome.

While walking the hallways near my new office area, I noticed an intriguing phenomenon I called “floor study.” Graduate students and some faculty, upon seeing me approaching down the hall, would suddenly study the floor. I kept looking at the floor, thinking I had missed some subtle or fascinating geophysical phenomena. Had the floor been designed like a constellation of planets and I had missed it? It took a week before I realized that my colleagues were not actually interested in the floor. Instead, they were introverts, challenged by a range of everyday social interactions, including saying hello to someone new.

After this realization, I always said hello, and would sometimes play this imaginary message each time I saw a Geophysics graduate student or faculty member, as if I had telepathic powers and could read the ideas flowing through their minds: “Caution. Bipedal creature, of the species *homo sapiens*, approaching. Avoid eye contact; the creature will soon pass by. Beep.” I threw in the beep because the behavior I had witnessed was so robotic, consistent. As the fall semester unfolded, I met my first rebel. A Geophysics faculty member saw me in the break room, next to the microwave. What he did next had not happened in weeks: he extended his hand, smiled (think of it), looked me in the eye (yes, this happened), and said his name. Only after he shook my hand did I recover enough to say my name and recommence a typical human conversation. I had become so accustomed to the asocial floor study, almost adapted to it. Soon after, I met other Geophysics rebels, who intended to connect with me, and some gave me a warm welcome.

Later, I would discover that a psychologist and his colleagues at Purdue dubbed this diversity of approaches person-thing orientation, wherein certain individuals have more interest in things than people or vice versa [24]. This study found correlations between certain person-thing interests and academic majors, and retention connected to thing-interests in science and engineering [24]. So how does a person-oriented individual navigate a thing-oriented realm?

As I became acquainted with other Geophysics Dept. faculty, I realized how they contrasted with the gender and somewhat racially diverse faculty at my previous university. The Geophysics faculty were mostly male, and many had spouses who did not work outside the home, a phenomenon I did not think was widespread outside 1950s sitcoms.... I sometimes wondered if I had stepped onto the set of *Leave it to Beaver*.

Collaborative Problem Solving

The Accreditation Board for Engineering and Technology (ABET) made significant changes in their accreditation criteria in the late 1990s, shifting from an approach of simply counting which

courses and requirements students had completed to an approach in which evidence was marshalled to show what students had learned and were able to do. In short, the shift greatly augmented the richness of the assessment data. In so doing, it also greatly increased the load on assessment committees, and I found myself on one of those.

Sitting in a room of each department's assessment committee, we brainstormed, led by a facilitator who had assessed other universities using the new ABET criteria. Over the course of two hours, the people in that room went from somewhat daunted at the assessment challenge before us to confident in how to approach this complex problem-solving task. Most striking was the "can-do" attitude that marked this novel problem-solving task, along with the collaborative spirit in the room. Each departmental committee developed preliminary data collection ideas, and shared those with the other committees. An *esprit de corps* of playful, collaborative problem solving was palpable. Instead of being overwhelmed by the task, which my department head was at the outset, the group of mostly engineers threw themselves at the task and learned from other group's brainstorms. From daunted to confident in under two hours, with plucky enthusiasm to boot! I walked out of there invigorated by the experience of solving problems *with* engineers, struck by how each group had offered effective ideas that could be adapted to other departmental contexts.

One of the many reasons I have stayed in engineering education is this enthusiastic embrace of complexity and the can-do spirit of solving problems together. My experiences later, on National Science Foundation research teams and at American Society for Engineering Education conferences, only bolstered my mostly positive experiences of solving problems with engineers. Occasionally I nudge some engineers to consider research methods that are better suited to the research questions, rather than (over)relying on quantitative data (the subject of a *Journal of Engineering Education* article I co-authored) [25]. I may point out how the social and technical dimensions of engineering problems both need consideration and often have interplays (as I have in two books and an edited collection) [22], [26], [27]. But I am consistently impressed by the collaborative problem-solving and enthusiasm that occurs when engineers are introduced to a complex problem. This means that engineers often have the right growth mindset to address complex problems. The challenge is in how those problems are framed, as described below.

We Don't Feel

While teaching a colleague's class in the early 2000s, I asked students who had read about moral dilemmas linked to technology this question: "How do you feel about these dilemmas?" From the second row, a student shook his head and corrected me: "We're engineers. We don't feel. We think."

This was a decade before the publication of Jonathan Haidt's landmark book, *The Righteous Mind: Why Good People are Divided by Politics and Religion* [28]. In it, Haidt examines research on the origins of morality, and finds that while innate factors and social learning shape our morality, it is largely driven by intuition, not by reason. In fact, reason is often added after the fact, in what Haidt calls a "post hoc" addition to what our moral intuitions have already worked out. In short, Haidt's response to this student would be something along these lines: You are human beings, so you use complex intuitive (including some emotional) strategies in making

decisions, often unconsciously. Thinking largely occurs after a decision has been made, so we need to be wary of confirmation bias.

The notion that feeling can be separated from a human being, simply because he or she is becoming or has become an engineer, stayed with me, particularly since so many engineering decisions involve some degree of micro- or macro-ethical problem solving [29]; but also because this event is connected to one of the single most common complaints I heard from undergraduates in engineering education: they *felt* forced to compartmentalize their lives. They noted the pressure to put aside their passions, emotions, political, environmental, and social commitments, cultural values, and more when they walked in the door of the engineering classroom. Here I could delve into many anxiety and tear-filled conversations with students in my office, about engineers who feel that they just do not fit or belong in engineering—yet are simultaneously being taught not to feel. Some of those students, often extremely capable ones, dropped out.

The compartmentalization in engineering education classrooms was done, these students told me, in the name of teaching them to be objective, to reason scientifically (in an attempt to circumvent what Haidt discovered as a process that transcends cultures--we tend to intuit first, and reason second). Most social scientists recognize that even though data-driven approaches can reduce whim and caprice, objectivity is largely an illusion *when making decisions that involve people and communities*. The idea that humans can successfully compartmentalize themselves was as fascinating as it seemed dangerous to one's mental health, especially to bringing one's whole self to engineering. If engineering is design for people by people, why does the myth of objectivity persist?

The Myth of Objectivity

In October 2008, my perspective on engineering and engineering education shifted, thanks largely to meeting scholars at a National Academy of Engineering invited workshop [30]. My invitation stemmed from work connecting engineering and sustainable community development, and other scholars were invited due to work connecting engineering and social justice. Prior to this time, I thought social justice referred to some crazy extremists on the Internet. I was to learn much from the workshop; for instance, engineering education scholar Donna Riley spoke about her recently published book *Engineering and Social Justice* [31], including work on mindsets in engineering that prevent engineers from acknowledging the socially embedded nature of engineering practice.

One of those mindsets involves positivism and the myth of objectivity. Both lead to overly simplistic dichotomies. Positivism, as Riley explains, can lead to a dichotomy on what forms of knowledge are—and are not—valued:

... the engineer relies on the scientific method, using mathematics to create an estimate and then designing and conducting an experiment to make a measurement. This exclusive reliance on the scientific method to reveal knowledge is known to philosophers as *positivism*. Positivist epistemology is a common mindset in engineering (certainly, our education trains us in this way). Without an awareness of alternative epistemologies, one

adhering to this mindset might simply characterize scientific knowledge as “true” or “factual” and view other kinds of knowledge as “less reliable” or as “opinion” [31].

Similarly, the myth of objectivity can create dichotomies of valuing “objective” knowledge and devaluing other forms of knowledge. When the objectivity myth is combined with technological determinism, the consequences can mean crucial social dimensions of engineering problems are rendered invisible or irrelevant:

Technological determinism holds that technology develops on its own in a self-propelling fashion (i.e., without regard to social forces) and that its innovations, in turn, impact society and drive political, cultural, and economic developments. This perspective is found in engineering when concern is placed on the impacts of technology on society without consideration for how society also constructs technology. Positivism and technological determinism lead many engineers to believe that their work is objective and that science itself is objective [31].

Over 30 years of scholarship in Science and Technology Studies calls into question the idea that science and scientific research are objective. Riley notes that what scientific research is and is not funded, is and is not published, and which scientific fields are or are not supported can all be issues of power and value more than of objective science [31]. She notes that such issues surface, for example, when climate science is largely defunded under some presidential administrations. Riley also quotes Harding’s idea that overreliance on “the ideal of one true science obscures the fact that any system of knowledge will generate systematic patterns of ignorance as well as of knowledge” [32]. Neither Riley nor Harding advocates jettisoning scientific methods, but both question the simplistic, dichotomous knowledge valuations that can emerge in engineering and science.

The Engineering Brotherhood

In the mid 2000s, at an Engineers Without Borders conference dinner, I happened to sit with an alumnus from the university I had joined in the late 1990s. As soon as he saw my nametag and institution, he smiled broadly and launched into a long, nostalgic description of his wonderful experience as an undergraduate at our institution. He was ebullient, talking about all the transformative experiences he had in and outside the classroom. Dinner was marked by a level of enthusiasm for my home institution and a warmth for everything about it: from our mascot to our unique traditions. Just before dessert, he asked me which department I was in. When I told him that I was in the Humanities, Arts and Social Sciences he sat still, as if he’d been turned to petrified rock. Recovering, he drank a sip of water, slowly turned to the person on the other side of him at our table, and did not say another word to me...ever again.

This was not the first nor the last time I was snubbed by engineering colleagues for not being an engineer. The title of this section is “engineering brotherhood” because in the last three decades this snubbing has not happened to me by female engineering colleagues. Such snubbing by male colleagues has been echoed in many conversations with engineering students and faculty who receive diverse messages about who belongs in engineering and about the devaluation of the “emotional,” “feeling” side of human experience. What do such events say about what engineers

value? What forms of hierarchy are at work? What forms of talent might we be pushing away from engineering?

Depoliticization

Erin Cech's work has been particularly insightful in answering the above questions. Cech describes how and why some engineering educators and engineers make a mental separation between the technical and social realms. One engineering ideology that facilitates that separation is depoliticization, "the belief that engineering is a 'technical' space where 'social' or 'political' issues such as inequality are tangential to engineers' work" [33]. That is, under the ideology of depoliticization, engineering is rendered as kind of a pure space, uncorrupted by impure political and social factors: "the ideology of depoliticization is the belief that engineering work *can* and should be disconnected from 'social' and 'political' concerns because such considerations may bias otherwise 'pure' engineering practice" [34].

This was a startling insight, and it provided one window into why so many students and faculty lament the pressure to compartmentalize their whole selves in engineering education, to NOT bring their whole selves to their process of preparing to become an engineer. As students and faculty have often told me, being your whole self in engineering comes with great risks--but so does hiding the parts of yourself that matter.

The Required Oath

In the years after 9/11, conservative groups feared the spread of liberal ideas, and sought to weed out radical fringes of the academy. One faculty member at CU-Boulder, Ward Churchill, a professor in the ethnic studies department known for incendiary and controversial ideas, became the poster child of what is wrong with academia. One of his essays had described the Sept. 11, 2001 attacks as a natural consequence of U.S. foreign policy since WWII and depicted those working in the "technocratic corps" in the World Trade Center as "little Eichmanns" [35]. In 2005, allegations of research misconduct surfaced, and Churchill was fired in 2007 [36]. Churchill sued the university for wrongful termination, and in 2009, a court sided with Churchill [37].

During this period, conservative politicians wanted to ensure that K-12 and university students were protected from the perceived pitfalls of certain kinds of ideas in education and academia. A 1969 law that mandated public university and K-12 faculty and staff at public institutions of higher education to take an oath to the U.S. and Colorado Constitutions had not been enforced. Suddenly, it became "required." Human Resources produced a form that had to be signed. By not signing, one risked termination.

The response to this dictum from several of my engineering faculty colleagues was straightforward: why would anyone object to loyalty to these constitutions, given how broad they are? They considered their research, teaching, and service to be completely separate from the politics that led to this requirement.

One of my colleagues, however, saw the requirement quite differently. What was at risk by signing an Oath to these constitutions? A few summers before, this colleague had married in Canada. At the time, conservatives had proposed an amendment to the U.S. Constitution describing marriage as a union “between one man and one woman.” When faculty asked about the consequences of not signing, we were told disciplinary actions would be pursued, since the university could be fined and administrators could be jailed. For my colleague, an untenured professor, “disciplinary actions” was code for a movement toward termination. My colleague signed the document. Afterwards, distraught, grief stricken, and conflicted, my colleague asked me these questions: “What if they say my marriage is now nullified? I may have just signed an oath that violates a significant part of who I am and who I would like to spend my life with. How can they get away with this?”

Separating the technical and social realms, a phenomenon called technical-social dualism [38], [39], is a remarkable mental feat. It requires one to create a bubble around all things technical, and to keep out all things social, even when evidence indicates the two are inextricably intertwined. Technical-social dualism is also a cause for why many in engineering cannot bring their whole selves to their work.

“They Have Never Done Anything for Me”

In the early 2010s, I’m riding in a commuter van with several fellow commuters. One of them, an electrical engineer, begins a long rant about the ills of the government (local, state, federal, you name it, “they’re all bad”). He ends it by pronouncing, “They have never done anything for me.”

The next day, he was not on the van, and several of us listed components in the social support system that he had rendered invisible. He had gone to public school, and a public institution of higher education. Likely while growing up he had benefited from the existence of fire fighters and police, and even if he never had to call them for assistance, they were there. He surely played in public parks and recreation areas. He was driving a van sponsored by a government municipal planning organization, subsidized partially by government funding, on an interstate built and resurfaced by government funding. And he worked for the National Renewable Energy Laboratory, a government lab. The list went on, but it was less the length of the list that fascinated us, and more that he had discounted so much of the social support system that had enabled his education, welfare, transportation, current employment, and much more.

The Myths of Meritocracy and Individualism

One of the single most common myths I have encountered among engineering students and faculty was the myth of meritocracy and of individualism. Meritocracy is a core belief in U.S. culture [40]. Most Americans endorse the ideology of meritocracy, despite evidence from their own lived experience that show the importance of non-merit factors. Even some of our sayings accentuate non-merit factors. For instance, “it takes money to make money (inheritance); it’s not what you know but whom you know (connections); what matters is being in the right place at the right time (luck); the playing field isn’t level (discrimination); and he or she married into money (marriage)” [40]. But as these authors show, the myth is woven into U.S. history, with religious,

political, economic, and cultural origins. In meritocracy, the individual alone is responsible for his or her success, much like the electrical engineer who denounced the government, despite how much it facilitated his own success and wellbeing.

Cech's research has shown that these ideologies resonate strongly in engineering:

Although widespread in the United States, the meritocratic ideology is particularly prevalent in engineering [33], where hallowed success stories are those of lone, white male engineers who, with fortitude and a good idea, achieved greatness out of home garages [41]. Through the meritocratic frame, most social systems are seen as fair and equitable. Thus, even if individual engineers recognize systematic differences in opportunity structures and outcomes, such differences are not necessarily framed as inequalities in need of resolution—and certainly not by engineers [34].

My own social science background informs me that the binaries I have encountered in engineering education--social vs. technical, hard vs. soft skills, objective vs. subjective, etc.--are largely socially constructed. Bringing a whole self that spans those binaries is challenging, and I find myself tremendously grateful for the network of binary and boundary spanners I have encountered. Many of them I've cited in my narrative, and many others have inspired me to risk being who I am. Thank you! I hope those in engineering education--especially readers fairly new to the field or at the outset of their careers--continue to strengthen their network of rebels and boundary spanners. With time, there will be more of us if we connect and collaborate.

(6.) Narrative Reflection by Dr. Julia D. Thompson

Over the course of the pandemic, I have befriended a tree. To be specific, she is a cluster of Monterey Cypress trees in the North-East corner of Golden Gate park. Their trunks have merged together so she appears in the world as one beautiful, majestic tree with a base of about 15 feet in diameter and is about 60 feet tall. I sit regularly at her trunk, and tell her everything that is on my heart. I should also point out that I do not in fact know her gender, nor anything about sex distinctions of Monterey Cypress. I have gendered her as she, and since gender is a human construct, I do not think she minds.

Early January 2021, I was preparing a syllabus for a course I would be teaching the following fall. It is a course I am creating on liberatory design, the course takes critical and liberatory pedagogies and integrates it with design thinking while co-designing a game with a local after-school program. As I was writing the syllabus, I felt overwhelmed with struggle and anxiety. There was tightness in the region of my body above my belly button and below my rib cage, also known as the solar plexus.

Throughout my education, I have experienced pushes and pulls of dehumanization and striving for equity. Throughout my experience of academia, I feel like I have had to compartmentalize myself and to fit within boxes while also fighting to be outside the boxes. These emotions are connected to the tightness and anxiety of my solar plexus and feels depleting. In high school chemistry, I was targeted by two male chemistry teachers and explicitly told I did not belong. The first one pulled me aside and suggested I change teachers because I regularly questioned him

and did not know the answer and took it personally. I did change teachers half-way through the year and the second one, no doubt in communication with the first, actively picked at me in class every time I asked anything. I regularly held back tears in class. The fact that I later became a chemical engineering major speaks directly to this feeling of not belonging and forcing myself to belong.

As an undergraduate student, I had an epiphany that my education was so focused on the technical components, that students are not able to integrate the social and environmental aspects of technology. It was incredibly eye opening, and led me to a spiritual awakening, seeing the world in a new and complex way. I wrote a letter to my department heads, explaining that there needs to be more space for students to explore personal interests and social and environmental courses. One professor pulled me aside and suggested that I chose the wrong major. It did not take me long to break down crying in front of him. There is something about being a young woman alone with a professor telling you that you chose the wrong path, that you can believe it in that moment. It wasn't until I was walking home from that meeting that I realized that I was right, it was the field that was wrong, and not me. Ultimately, three months after I sent the letter, the department announced curriculum changes. Four of the seven recommendations I outlined were implemented. As a graduate student, I felt a strong sense of community within my academic department, while also helping organize rallies to support black students who were targeted by racist acts and in protests against the newly appointed neo-liberal university president. Overall, this sense of lack of belonging and fighting to belong is something that has inspired me, and also caused deep pain and suffering. It is an inner well, for better or worse, something that I have drawn from.

So, this January, as I was creating this liberatory design course, I was feeling the anxiety. The push and pull of years of belonging and not belonging. I am currently working at a university that deeply values and aligns with the work of equity and justice that I deeply care about and supports my aspiration to integrate it into engineering. Yet, I still feel this struggle when I attempt to reach within myself to do my work. It was exhausting, and not sustainable.

I decided to tell my tree about this dynamic, about my anxiety. I went, sat at her trunk, and told her about my course, about the tightness in my solar plexus, about the feelings of dehumanization, and the fight for equity and justice. I told her how I feel like I am depleting my life energy as a way to get work done, and that this is not how I want to be.

Then, I listen to her and observe her. I noticed her branches, that she is always present the moment. I observed the light on her leaves, breathed in her oxygen, and examined the squirrels and the spiders she housed. I imagine what it must be like to have roots with soil compressed around me. I then slowly walk away. I notice the sensations of my feet moving, something she is unable to do, and I wonder if I can change my story. Change the way I work, and instead of having my work come from this struggle and tension, what if I had it come from my feet. That each piece of work didn't deplete me, but it was just a step in a direction I wanted to take.

I reframed my work, and it seems to have worked. My anxiety has reduced, and I feel a bit more presence in life, and a little close to my sister tree.

I was able to complete the syllabus that day. It is now in review by the community engagement committee for the university. I am meeting regularly with a mentor/coach to help me plan and organize the course. This has also rippled out in many other places, and I am feeling more grounded and rooted in life.

Synthesis and summary

When we look at our collective narratives, several themes emerge: Belonging, human growth as a journey, and reflective self-awareness. First, we have all experienced outsider status and we have struggled (and continue to struggle) with a sense of belonging in engineering and/or academia. This struggle was perhaps best described by co-author Thompson: "...there have been moments and periods of time when I felt dehumanized." As a first-year engineering student, one of our female coauthors (Dr. Lima) was told, "I'm not sure why you're here (at professor's office hours), because it's pretty clear that you have no idea what you are doing, and you are so confused that I can't help you. It's been scientifically proven that men have superior spatial abilities. Maybe you should look for a new major." These highlight challenges to bringing our whole and best selves to our work as engineering educators.

Second, that becoming yourself is an on-going journey and an ever-evolving story. It is helpful, we think, to view our lives as works in progress. Each of us has found agency (the ability to influence positively as an individual within a broader system) but has also struggled with that agency at times. The concept of evolution is helpful to us in framing our challenges, both as individuals and in the larger system in which we operate, as dynamic and changeable.

Finally, we were struck by the ways in which each of us operates with intentionality—this reflective approach results in boundary spanning, with each of us developing a set of personal skills to address challenges. In her narrative, co-author Bielefeldt said "Patterson and Gray [21] also note the need for teachers to develop the practices of 'deep self-analysis.' I do believe that I have this perspective on my teaching. Although the deep self-analysis perhaps needs to permeate more clearly into a life-wide view."

Collectively, we see opportunities and barriers in the process of bringing our whole selves to our work. Barriers include historical structures of engineering; the military-industrial-government complex which underpins much of engineering can be difficult to navigate if you endeavor to operate outside of this paradigm. In his narrative, co-author Leydens described other barriers including compartmentalization, depoliticization, positivism, meritocratic ideology. The dehumanization that many of us have felt is a function of this structural barrier. However, there are great opportunities as well. Co-author Leydens noted engineering's can-do *esprit de corps* of playful, collaborative, problem solving often characterized by plucky enthusiasm. Our narratives illustrate how each of us has sought to work around barriers, by creating collaborative community, finding solidarity, and enthusiastically transcending boundaries. We invite our panel audience to join us in discovering together how to bring our best, whole selves to our shared work in engineering and engineering education.

We close this exploration with two more sources of inspiration for the journeys of all our readers:

To pray you open your whole self
To sky, to earth, to sun, to moon

To one whole voice that is you.
And know there is more
That you can't see, can't hear;
Can't know except in moments
Steadily growing, and in languages
That aren't always sound but other
Circles of motion.

-From "Eagle Poem," by Joy Harjo [42]

"True belonging doesn't require that we change who we are;
it requires that we BE who we are." [43]

References

- [1] Moyers, Bill. 1973, A Conversation with Maya Angelou. In Bill Moyers Journal: Original Series. Available: <https://billmoyers.com/content/conversation-maya-angelou/> [Accessed March 5, 2021.]
- [2] Levin, Jenifer. 1993. *The Sea of Light*. Plume, p. 380-381
- [3] Nieuwsma, Dean. 2013. Engineering, Social Justice, and Peace: Strategies for Educational and Professional Reform. In: Lucena J. (eds) *Engineering Education for Social Justice*. Philosophy of Engineering and Technology, vol. 10: 19-40. Springer, Dordrecht.
- [4] Riley, D. 2013. Power. Systems. Engineering. Traveling Lines of Resistance in Academic Institutions. In: Lucena J. (eds) *Engineering Education for Social Justice*. Philosophy of Engineering and Technology, vol. 10: 41-63. Springer, Dordrecht.
- [5] Downey, G. L., & Lucena, J. C. 1997. Engineering selves: Hiring in to a contested field of education. In G. L. Downey & J. Dumit (Eds.), *Cyborgs & citadels: Anthropological interventions in emerging sciences and technologies*. Santa Fe: School for Advanced Research Press.
- [6] Trahar, S. 2009. Beyond the story itself: Narrative inquiry and autoethnography in intercultural research in higher education. *Forum Qualitative Social Research* 10 (1), Art. 30.
- [7] McAlpine, L. 2016. Why might you use narrative methodology? A story about narrative. *Eesti Haridusteaduste Ajakiri*, 4 (1), 32-57. DOI: 10.12697/eha.2016.4.1.02b
- [8] Denshire, S. 2013. Autoethnography. *Sociopedia*. 12 pp. DOI: 10.1177/205684601351
- [9] Aleong, R.J. 2012. In search of meaning and identity: an autoethnography of a graduate student navigating the field of engineering education. American Society for Engineering Education Annual Conference & Exposition, Paper AC 2012-3517. 8 pp.
- [10] Cicek, J.S., P.K. Sheridan, L.A. Kuley, R. Paul. 2017. Through 'collaborative autoethnography': Researchers explore their role as participants in characterizing the

- identities of engineering education graduate students in Canada. American Society for Engineering Education Annual Conference & Exposition, Paper ID #19611. 10 pp.
- [11] Sochacka, N. W., Guyotte, K. W., & Walther, J. 2016. Learning together: A collaborative autoethnographic exploration of STEAM (STEM+ the Arts) education. *Journal of Engineering Education*, 105(1), 15-42.
- [12] Thompson, J.D., M. Chua, C.H. Joslyn. 2014. Engineering and engineering education as spiritual vocations. American Society for Engineering Education Annual Conference & Exposition, Paper ID #9903, 11 pp.
- [13] O'Meara, K.A. 2008. Motivation for faculty community engagement: Learning from exemplars. *Journal of Higher Education Outreach and Engagement*. 12 (1), p. 7-29.
- [14] Selmo, L. 2015. The narrative approach in service-learning methodology: A case study. *The International Journal of Research on Service-Learning and Community Engagement*. 3 (1),
- [15] Malpert, A.V. 2015. The Community Narrative Research Project: Organizational Learning and Change Through College-Based Community Research Initiatives. Honors Thesis, Dept. of Psychology, Rhodes College. 86 pp.
- [16] Dare, M.L., F. Vanclay, J. Schirmer. 2011. Understanding community engagement in plantation forest management: insights from practitioner and community narratives. *Journal of Environmental Planning and Management*. 54 (9), 1149-1168.
- [17] Boxelaar, L., M. Paine, R. Beilin. 2006. Community engagement and public administration: Of silos, overlays and technologies of government. *Australian Journal of Public Administration*, 65 (1), 113-126.
- [18] Robert M. Sellers quoted in Alvarez, Maximillian. 2020. Slouching Toward Equity: The lonely task of the chief diversity officer. *Chronicle of Higher Education* 67(2): Sept 14, 2020. <https://www.chronicle.com/article/slouching-toward-equity>
- [19] Sword, Helen. 2017. *Air and Light and Time and Space: How Successful Academics Write*. Harvard University Press.
- [20] Winn, M. T. 2018. *Justice on both sides: Transforming education through restorative justice*. Cambridge, MA: Harvard Education Press
- [21] Patterson, Alexis, and Salina Gray. 2019. Teaching to Transform: (W)holistic Science Pedagogy. *Theory Into Practice* 58:4, 328-337
- [22] Riley, Donna. 2018. Forward. In: Leydens, J.A. and J.C. Lucena. *Engineering Justice: Transforming Engineering Education and Practice*. IEEE Press. Piscataway NJ.
- [23] Wellum, Caleb. 2021. The damaging impact of unattainable expectations. *Inside Higher Edu*. Available at: <https://www.insidehighered.com/views/2021/02/25/how-college-marketing-can-exacerbate-student-mental-health-issues-opinion> Accessed March 1, 2021.
- [24] Graziano, W. G., Habashi, M. M., Evangelou, D., & Ngambeki, I. 2012. Orientations and motivations: Are you a “people person,” “thing person,” or both? *Motivation and Emotion*, 36(4), 465–477. <https://doi.org/DOI 1 0.1007 Is 11031-011-9273-2>
- [25] J.A. Leydens, B.M. Moskal, M.J. Pavelich. 2004. “Qualitative methods used in the assessment of engineering education,” *Journal of Engineering Education*, vol. 93 (1), pp. 65-72.
- [26] J. Lucena, J. Schneider, and J.A. Leydens. 2010. “Engineering and sustainable community development,” *Synthesis Lectures on Engineers, Technology, and Society*, vol. 5 (1), pp. 1-230.
- [27] J.A. Leydens, Ed. 2014. *Sociotechnical Communication in Engineering*. New York: Routledge.

- [28] Haidt, J. 2012. *The righteous mind: Why good people are divided by politics and religion*. Pantheon Books.
- [29] Herkert, J. 2005. Ways of thinking about and teaching ethical problem solving: Microethics and macroethics in engineering. *Science and Engineering Ethics*, 11(3), 373–385.
- [30] National Academy of Engineering, & Advisory Group for the Center for Engineering, Ethics, and Society. 2010. *Engineering, Social Justice, and Sustainable Community Development: Summary of a Workshop*. National Academies Press.
- [31] Riley, D. 2008. *Engineering and social justice*. Morgan & Claypool.
- [32] Harding, S. 2006. *Science and social inequality: Feminist and postcolonial issues* (1st edition). University of Illinois Press. (p. 125, quoted in Riley, 2008, p. 42)
- [33] Cech E.A. 2013. The (Mis)Framing of Social Justice: Why Ideologies of Depoliticization and Meritocracy Hinder Engineers' Ability to Think About Social Injustices. In: Lucena J. (eds) *Engineering Education for Social Justice*. Philosophy of Engineering and Technology, vol. 10: 67-84. Springer, Dordrecht.
- [34] Cech, E. A. 2014. Culture of Disengagement in Engineering Education? *Science, Technology & Human Values*, 39(1), 42–72. <https://doi.org/10.1177/0162243913504305>
- [35] Brennan, C. 2005. College journalist touched off firestorm. *Rocky Mountain News*. (February 3, 2005).
<https://web.archive.org/web/20081016160806/http://www.rockymountainnews.com/news/2005/feb/03/college-journalist-touched-off-firestorm/>
- [36] Morson, B. 2007. CU regents fire Ward Churchill. *Rocky Mountain News*. (July 25, 2007).
<http://www.rockymountainnews.com/news/2007/jul/25/cu-regents-fire-ward-churchill/>
- [37] Johnson, K., & Seelye, K. Q. 2009. Jury says professor wrongly fired. *New York Times*. (April 3, 2009).
- [38] Faulkner, W. 2000. Dualisms, hierarchies and gender in engineering. *Social Studies of Science*, 30(5), 759–792.
- [39] Faulkner, W. 2007. 'Nuts and Bolts and People': Gender-Troubled Engineering Identities. *Social Studies of Science* *Social Studies of Science*, 37(3), 331–356.
- [40] McNamee, S. J., & Miller, R. K. 2014. *The meritocracy myth*. Rowman & Littlefield Publishers.
- [41] Hughes, Thomas P. 2005. *American Genesis: A Century of Invention and Technological Enthusiasm, 1870-1970*. Chicago: The University of Chicago Press.
- [42] Harjo, Joy. 1990. "Eagle Poem." From *Mad Love and War*. Wesleyan University Press. Available: <https://www.poetryfoundation.org/poems/46545/eagle-poem>
- [43] Brown, Brené. 2017. *Braving the Wilderness: The Quest for True Belonging and the Courage to Stand Alone*. New York: Random House.