

## **From Feminist Hacker Meet-ups to Engineering Educators: Implications of Social Movements in Technology for Change-making at the Level of Higher Education**

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**Abstract**

This paper shares nascent research on the organizing practices of feminist technology activists and open science hardware (OSH) developers who are concerned with how technologies (and subsequent knowledges about them) are defined, framed, further developed, shared, and in turn shape the worlds in which we live. They intend to bring a frame of reflexivity toward awareness of the politics imbued in technology as well as the often exclusionary cultures entangled therein. Further this research brings field work observations of these groups and their practices (designated as Study 1) into conversation with interviews of engineering education researchers (designated as Study 2). In that vein, this examination asks: What might an analysis of the practices and mindsets of feminist hacker and opensource science hardware groups contribute to the world of engineering education, specifically for educators interested in change-making strategies for creating a more equitable higher education environment that takes on issues of racism, sexism, heteronormativity, ableism, etc.?

With a theoretical grounding in the work of Myles Horton and the Highlander Research and Education Center's theory of change, bell hooks' liberatory pedagogies, and social movement theory from a science and technology studies (STS) perspective, this paper aims to examine how current social movements in technology, specifically the organizing work of feminist hacker and tech collectives as well as those working with opensource science hardware, might inform changes to engineering practice via educational reform. Data collection for this work involves participant observation from four different meetings and discursive analysis of websites and promotional materials. The result is a multi-modal analysis which will then be brought into conversation with previous work on 32 interviews with engineering education practitioners who have identified issues in the discipline and are interested in enacting change in the higher institutional setting. Such work has implications for engineering education reform and organizing possibilities toward enabling educators to seed the changes they seek.

**Background: Prior Research and Fields of Influence**

One of the main fields of inquiry for this research project has been how to leverage and query the possibility for social movement organizing in academia from the ground up while demanding for and advocating for change at the institutional level. For our analytical purchase and contributions, we look to social movement studies in STS, our own prior research into organizing work in higher academic institutional settings, feminist technology movements, and open science hardware initiatives. The hope is that these movements might inspire, inform, and guide change efforts within engineering education.

Studies that follow social movements in STS [1], [2], [3], [4] complicate the political process model that focus on law and policy change, demonstrating that the collective actions associated with social movements and science can target institutions other than the state as well as work towards cultural shifts. In his work on AIDS Activism and the ACT-UP community, Epstein [2] demonstrates the possibilities for lay experts to demand change in medical studies, while also highlighting issues of privilege in terms of who is heard and seen as community experts. Brown [1] explores different ways of knowing embedded in communities dealing with toxics pollution that trouble institutional expertise, and Moore [3] studies the possibilities for changing the science institution through research that centers diverse public needs and questions.

In this sense, social movements can cause effective change and have implications for cultures of technoscientific practice. By analyzing the leveraging of resources and tactics used to establish feminist technology collectives and open science hardware groups, we intend to examine how they disrupt the “organized moral order” of corporate technological control [3, p. 15]. Further, we are interested in how organizing within technology cultures might inform the barriers and aspirations for change identified by engineering educators.

Feminist hacker collectives and the open science hardware (OSH) community have different, yet intersecting narratives. Feminist hacker collectives started to organize in the European context in the early 2000s and in the North American and South American context around the early and mid-2010s. These groups formed in conversation with male-dominated software and hardware hacker collectives due to experiences of implicit and explicit misogyny in dominant technology cultures, such as the tech start-up culture of Silicon Valley. Previous research into the work of feminist technology and hacker collectives often connects their organizing work to movements such as the women’s health movement in the 1970s, specifically in their cultivation of safe space technologies [5] as modes of tactical exclusions as well as design [6] and pedagogical innovations and cultural shifts [7], [8] for shifting deeply embedded power dynamics in technology use, development, and transfer. Meanwhile, OSH groups, which started to form in the 2010s, spring out of free and open software (F/OSS) communities and are more in conversation with citizen science initiatives toward democratizing expensive hardware, methods, and devices for community sensing projects.

Our own research is mostly interested in working with such communities to enact future visioning and explorations of how the world of technoscience development might be otherwise, of which engineering education is a huge part. Although they are mostly working outside of the institutional setting, especially as they work to establish alternative space and practices outside of the dominant discourse, the work and motivations of both feminist hacker collectives and open source science hardware communities have implications for thinking through how to organize and enact real-world change in terms of pedagogy, design, and more deeply weaving ethics and explicit value-systems into engineering education and practice.

In a previous paper, we sought lessons for change in engineering education from movements not only within science and technology cultures, but also within higher education institutional settings. Prior higher education change movements we examined include the efforts to remove defense research institutes from campuses during the Vietnam War; to establish and sustain women's and ethnic studies programs; to divest from South African apartheid or from the fossil fuel industry; to extricate universities from relationships with sweatshop labor, water privatization, or exploitive food vendors; and to abandon vestiges of racism in campus mascots or monuments. These are campaigns led by students, faculty, and administrators, and while enacted through the institution's structural policies and resource allocations, such campaigns also have a great impact on the campus climate and the knowledge-production practices both enacted by and available to students and faculty. Demonstrative of cross-group collaborations, students will take up initiatives to sustain such programs in a generative form that does not only rely on administrative or infrastructural resources, but also on student engagement, participation, organizing, and networks – as well as faculty support.

What we found in the examples canvassed in our previous study is that such campaigns are never static nor neatly claimed to be over and done in short order, but are instead ongoing conversations with shifting structures, power relations, norms, identities and visions for diverse futures. Some campaigns within higher education do not go well, and it is important to learn from these examples as well as the successes. Staunch resistance to change can come from the institution, or it can come from the public, alumni, or student interests. In other cases, some issues have gone from being shifted or “won,” only to be shifted back in the direction of corporate interest or previous oppressive systems. Meanwhile, there is also possibility for the co-optation of certain campaigns that originally had good or radical intentions for change at the structural level; this has occurred across campaigns from LGBTQ+ inclusion to food-waste management, to greenwashing of sustainability efforts. One specific lesson culled from this overview is that institutional isomorphism is often at play in these spaces [10], [11]; as some campaigns reach success on certain campuses, others will follow suit.

### **Theoretical Framework**

One of the theoretical streams informing our work emerges from the Highlander Research and Education Center in eastern Tennessee. Myles Horton's [12] theory of popular education and the Center's tools for participatory action research developed through Southern labor, civil rights, and environmental justice movements [13] emphasize the agency of communities in creating change. Highlander's theory of change [14] begins with a root cause analysis identifying the systems of power underlying the status quo, such as global neoliberalism, sexism, racism, and heterosexism. Taking stock of the community's values contrasted against the status quo, via a process of deep listening [15] that elevates the leadership of people most impacted, increases

empathy and facilitates the emergence of future visioning. Change is ultimately enacted through processes of community-building, organizing, and education, creating transformative experiences in democratic and reflective spaces that directly address root causes. This may include every-day actions such as cooking, gardening, building, establishing space, as well as performance and creative output.

In conversation with Highlander's practices of creative resistance and agency building, we also take from the foundational work of Imarisha Walidah and Adrienne Maree Brown regarding the practice of emergent strategies for community organizing and enacting change [16]. Brown and Walidah have established the technique of future visioning through the writing of science fiction narratives that enable social critique as well as creative resistance and playful enactments of how the world might be otherwise. From the perspective of pedagogical shifts, we take from bell hooks engaged pedagogies [17] that highlight the importance of relational learning, engaged practice, and dynamics of discomfort to move through understandings of difference. We aim to highlight importance of the everyday doing and what might be seen as routine tasks as reflections of theory towards change-making.

Finally, for this paper project and research we engage feminist technoscience theorizations on the politics of care [18], [19], and the manifestation of power dynamics, comforts, discomforts, inclusions, and exclusions that come to light when assessing care practices enacted between human as well as non-human actors, particularly in feminist technology collectives and OSH groups.

## **Methods**

As the following table clarifies, there are two datasets and studies under the umbrella of our project toward seeding a campaign in engineering education, with Study 1 being primarily based on fieldwork and ethnographic observations of feminist hacker meetings and OSH group activities, whereas Study 2 is based on relational interview work with engineering education researchers, further details of which can be found in Quiles-Ramos et al., this conference. As such we intend to see how the practices of feminist hacker collectives and OSH groups (who have been working to organize and enact change at various scales in the shaping of technologies), can inform our own organizing practices and change-making strategies with and for engineering educators around technology cultures (as in their development, design, education, etc.).

	Study 1	Study 2
Participants/Sites	Feminist Hacker Meetups and Opensource Science Hardware Meetings	Engineering Education Researchers
Aims	Identifying organizing strategies and sustaining practices	Identifying motivations, concerns, networks, and common causes for organizing
Methods	Participant Observation; Field notes	Semi-structured open-ended relational interviews Qualitative analysis; network analysis
Theoretical Frameworks	Feminist Pedagogies Feminist Technoscience Politics of Care	Organizational networks Social Movement Theory
Population Characteristics and Dynamics	Meetups in Montreal, Canada; Santiago, Chile; Bologna, Italy; Vallbona D’Anoia, Catalonia  Women-only as well as mixed gender spaces	32 interviewees  Involved in engineering education research across varied institution and position types; Demographics not collected
Topics Explored	Restorative practices; Embedded politics in technology and design; Creating alternative spaces and practices; Changing institutions	Access to cultural capital; Strong ties; weak ties; Reward structures/systems; Valuation of labor (gendered in certain ways); Changing institutions

In what we are designating here as Study 2, interviews with participants were conducted in an IRB approved, semi-structured relational format, modeled after Saul Alinsky’s [20] relational meetings. The interviews (n=32) were conducted over Skype with self-identified engineering education practitioners. Participants included individuals with faculty positions, corporate/industry positions, teaching & learning positions, and university leadership. Participants were recruited from engineering education email lists. Interviews were conducted in 2017 and 2018 using Internet video-conferencing and audio-recorded with prior informed consent. Interview transcripts were uploaded in Nvivo for qualitative analysis [21], [22], [23], using a coding scheme guided by our research questions, the results of infrastructural analysis of

faculty workloads and rewards [24], and toward identifying suggested issues as well as suggested mechanisms or tactics for change.

According to Alinsky's methods, relational meeting interviews are used in organizing efforts and are relatively short (30 minute) conversations for building relationships around common interests, potentially leading to future involvement in movement activities. For our purposes, interviews were based on a protocol, but the relational structure allowed for participants to navigate the conversation so responses were organic and not prompted. The goal was to listen to the person's story and areas of interest, connection or motivation, asking questions like, "Why do you do engineering education research?" or "what is your vision for change in our community?" Any places of excitement or consternation were explored with follow up questions uncovering the reasons behind the excitement, or what if anything the interviewee has done to address a troubling situation. At the end of the meeting, the interviewer reflects on the encounter to determine areas of mutual interest, networks, and potential action, as well as strategies for improving the interview process in the future [25], [26].

Analysis of the interview transcripts has been ongoing since 2018, and has resulted in a network analysis of strong and weak connections, in regards to valuation of engineering education research, and cultural capital implications that reinforce hierarchies along lines of difference and disadvantage those already at the margins [27].

In conjunction to these interviews, Study 1 was conducted at four different events in Montreal, Canada, Bologna, Italy, Santiago, Chile, and Vallbona D'Anoia, Catalonia. The first two listed were loosely related feminist hacker meetups based on feminist technology framings and creating alternative space for shifting power relations and dynamics in technology cultures. The second two meetings focused on developing community sensing and open science hardware technologies for measuring various forms of pollution. While not explicitly feminist, the meetings were deeply engaged in examining the politics embedded in technologies, established group values, and had members often directly confronting issues of racism, sexism, heteronormativity, and colonialism within the group settings. The focus of this observational research was to document and critically engage groups hoping to foster social movements in technology cultures, the mechanisms through which they organize, and how such tools and strategies worked (or failed).

This paper seeks to bring data from Study 1 and Study 2 together for a common analysis identifying barriers/issues, visions/aspirations, strategies, and implications for the development of organizing practices for change in engineering education. Thus, in order to put data from both studies together, a second round of coding was conducted on both data sets with an analytical eye toward considering specific practices and mechanisms for organizing a movement, based in grounded theory practices [21], [22], [23], as well as multi-site, multi-scale research design [28],

[29]. By bringing these two studies into conversation we are able to garner an intersectional analysis that considers how real-world non-academic work to shift technology cultures through grassroots organizing, hands-on workshops, and pedagogical innovation might inform engineering education desires, triumphs, failures, and capacities for change.

## **Results and Discussion**

For the purposes of this paper, the researchers brought Study 1 into conversation with Study 2 and thus overlapping themes and findings informed analysis of observations and interviews. Coding of interview transcripts was based on themes of future visioning, current barriers or issues at hand, possibilities for change, and concrete strategies and mechanisms that participants surmised might aid in organizing and change efforts. Specific recurring themes identified as issues, suggestions, and visionings (such as the absence of and need for continuing conversations throughout the year, the need to change engineering culture, devaluation of various forms of expertise other than the technical) were then brought into conversation with practices identified in studying feminist hacker and OSH development groups, where methods for addressing such issues in technology cultures had been identified and were being tested.

Many of the engineering educators interviewed cited either their own observations, or more often their lived experiences as motivation for wanting to enact and advocate for change. Foundational moments came from undergraduate and graduate pressures, recognition that there was a dearth of equity in engineering, as well as connections made at nascent stages during their career. For some, it was an interest in social justice, which they found generally lacking in engineering practice otherwise:

I did my PHD in electrical engineering and right at the end of the PhD I was basically not terribly happy with wanting to keep doing the same thing. I wanted to do something else, specifically something that would be socially relevant, something that connects to social justice. Those were very important to me and it didn't seem like the traditional research that I was doing would provide a pathway to it. In fact, it felt like it would take me away from it further and further. So I thought of education research as one possibility that could allow for a more social justice oriented work.

Many interviewees corroborated this narrative, and thus, in a sense, engineering education became a pathway toward organizing, movement-building, and advocating for change within the fields of engineering. Despite this, serious actionable change to the dominant discourse seems yet to happen. This was pointed out by several participants who described engineering curriculum as instrumentalist when taking ethics considerations into account, and often out of touch when considering real-world issues or projects. Similar sentiments were reflected in the feminist hacker groups who were frustrated with sexism, racism, heteronormativity, and other

gate-keeping behaviors that weeded out diverse backgrounds and which they experienced in digital and hardware technology cultures. Likewise, OSH groups were often trying to engage and involve community members who had diverse expertise, maybe did not initially consider themselves as “technical,” and were typically kept out of the narrative of hardware technology designs. As with the engineering education researchers, both groups see a dearth of intentional efforts to change dominant discourses in the rhetoric and practice of technology cultures, and were working to establish alternative spaces, practices, and cultures to counteract the dominant frame. A lesson for engineering education researchers to take from this recurring narrative that surfaced in interviews, might be to celebrate collectivist instincts, the need and desire for community, and to revisit the passion that brought them to the field of engineering education in the first place. Further, as the discipline and its researchers establish their own dominant discourses and practices, we should be mindful not to lose the connection to doing what matters.

Another theme identified in both sets of data was the exploration of and importance of pedagogical innovation toward changing mindsets and cultures, specifically as a way to critically engage and reflect on the values and ethics embedded in technology as well as educational design. For engineering educators, this arose most often as an issue in the curriculum – the siloing of engineering coursework from ethics or social responsibility explorations in science and technology studies classrooms. Participants identified the success of integration, such as problem-based work that had students engage real-world problems with dire consequences, or (in lieu of such examples) shared aspirations to achieve integration of ethics and social responsibility into the very fabric of technical engineering coursework. Similarly, the Eclectic Tech Carnival, a recurring feminist hacker meeting that convened in Bologna, Italy in October 2018, began the meeting with a hands-on activity that involved taking apart desktop computing towers. While the exercise was intended to gain knowledge of how black-boxed computer technology works, it also involved examining the politics and power built into material systems, such as the designation of “master” and “slave” connector ports. By pointing out that such language around computing has been normalized (and was never problematized to the point of being erased), the activity demonstrated how deeply embedded dominant white, masculinist, and colonialist framings create exclusionary and uncomfortable material cultures that keep those already on the margins outside of the technological landscape. This simple activity brings light to how normalized power relations in technology cultures might be further problematized in the engineering classroom, and begs further exploration into how such ideas might travel from feminist hacker collectives and OSH groups to the classroom setting.

Another shared and informative dynamic is that of collaboration and community-building. For the engineering education researchers, the ability to push research forward and continue working in liminal spaces was often contingent on finding supportive networks, organizations, and colleagues. This reflects similar organizing strategies identified by feminist hacker and OSH communities, which were strengthened by their support networks spanning institutions,

disciplines, and countries. Resources and the application for funding in diverse sectors is consistently shared amongst the network, as well as other actions of solidarity and support. Lack of institutional support and resources might be managed if engineering educators are able to find sympathetic colleagues, working groups, otherwise funded conferences, or can strategically and tactically leverage resources from other pools and research intentions.

As part of this, cross-disciplinarity becomes key. One interview participant pointed to how bringing engineering education into other disciplinary conferences on education must be further practiced and could have productive and mutually generative outcomes. However, while gatherings and conferences were pointed to as important and catalyzing, engineering educators contended that there was a need for routine engagement and follow through toward maintaining conversations and consistent change-making. In light of this, one participant related:

So I think one piece is the fact that I'm not directly connected with the engineering and education community on a day-to-day basis. The faculty that I work with ... the few that do education research will participate in aspects of engineering education but I would not say that they are very frequent members. So being able to have reasons to be connecting with my research community, more than just the one to two conferences a year, is really important to me.

Another researcher corroborated this need for a more regular meeting or way for interested individuals to connect: "And it's almost like there needs to be [an] organized monthly something, event that brings people together. There's a lot of great community folks [and] we stay connected conference to conference. It's hard sometimes for people to stay connected outside of that." This need for consistency and sustained communication was also an issue that feminist hacker collectives and OSH communities faced, and which they in some part alleviated through the use of electronic emailing lists and online repositories and websites for the dissemination of information. The Eclectic Tech Carnival group consistently meets online via an Internet Relay Chat (IRC), but then also shares these conversations through an electronic emailing list. Thus, this creates two possible levels of engagement, as there is a moment for real-time connections and then sharing of the discussion for those who were not able to take part, much in the way of meeting minutes.

When asked what specific tools or strategies might be helpful for organizing engineering educators, one interview participant specifically identified such electronic emailing lists as a possible tool for creating community and modes of collaboration on a consistent basis. They cited their experiences with electronic emailing lists in other academic realms for creating rich discussions and helpful conversations for sharing resources, mentorship strategies, and so forth: "I'm on some LISTSERVs for other kinds of fields that are really rich, like email LISTSERVs, where people will post questions like [about mentoring], or, "Does anyone have literature about

X?" I find them very helpful." The observed success of such electronic emailing lists for both the ETC group and for the Gathering for Open Science Hardware (GOSH), points to its use as a fruitful avenue for further actions and organizing with and for engineering educators. This mechanism is one that has been used effectively in connecting engineering education research centers, and might be expanded or replicated to involve a wider group. ASEE has also hosted many successful online communities of practice that might be used as a mechanism to connect more isolated engineering education researchers. In this vein, and borrowing from other social movement strategies, a conference call with a featured topic or panel could be another mechanism to increase community and connectedness among engineering education researchers.

Another dynamic that the feminist hacker communities and engineering education researchers shared involved their own gatekeeping mechanisms around collective values, intentions, and certain forms of expertise. One engineering education researcher identified a tension in this regard around wanting to ensure that EER is legitimized, and yet not wanting to exclude others, such as scholars of teaching and learning who do not engage formal research:

Interviewee: Legitimacy. I don't know, I guess I'm warring between the idea that everyone can do education research if you're teaching, or if it should be a little higher quality, more gate kept, more exclusive, in the sense that you have to know basic social science research methods to do the work. I'm just thinking of some of the ASEE talks that are just case studies of what I do in my class, and that's not scholarship, I think.

Interviewer: Absolutely. How do you think we can gain like quote, unquote, the legitimacy, or respect, for this type of research?

Interviewee: That's a great question. Because obviously we don't want to actively exclude people, including me, who don't have degrees in education. I think just training, like maybe the ASEE could have some workshops or there could be a little conference on, "So you want to study your class, here are some ways to do it."

Indeed, ASEE frequently hosts these kinds of opportunities at annual and regional conferences as well as through webinars, but reaching intended audiences can be a challenge. Similar issues arose in the feminist hacker collective groups around creating "safe space" technologies where everyone involved came to the table with shared values and an understanding that technology is built upon sexist, racist, colonialist, heteronormative structures, and that the spaces of its discussion and development often works to reinforce these narratives. Creating exclusionary space often meant establishing women, or women/non-binary/trans-only spaces so that everyone could start from the same mindset and with the same awareness.

And yet, in both studies, there were instances of wanting to create collaborations or shift mindsets across disciplines, across identity, and in conversation with different groups. One engineering education researcher relates:

I have a colleague in civil engineering who I was on a grant with. We started at [Institution] the same year, he's in civil engineering. We knew each other all the way back to my orientation, our orientation together into the college. He was interested in doing a grant, and so I was brought onto that as sort of the engineering education person. That's been a great experience to work with a near peer colleague in a traditional engineering field and to introduce him, for example, to the ASEE community, to see him go off into the disciplinary side, the disciplinary division of ASEE to present papers over there that I don't have anything to do with.

This sentiment was also reflected in many other interview participants who saw one of their goals, or a strategy toward creating change in engineering education more broadly, to be cultivating awareness and building capacity among engineering faculty to enact lessons of social responsibility and embed ethics into “typical” engineering coursework. For the feminist hacker collectives, there were often interests and intentions to have open or inclusive discussions around uncomfortable topics, which meant opening up workshops or events to all gender identities and expressions, but with a clear posting of values and expectations around language, actions, and engagements. In this sense, they wanted to take care (and be mindful of the politics of who is taking care and how care is defined) when talking about different values, and about topics that might cause friction or discomforts. One feminist hacker participant related a specific story of having an ally in computing who identified as a man and was not a feminist, but was working to understand and be in solidarity, and how conversations with him were grounding and helpful for developing her own thoughts around technology and feminism further. Engineering education can take away key lessons on how to create spaces that balance the need for community and solidarity with those of common experiences, with the need for engagement that can be educational for those in positions of privilege without being overly exhausting, unsafe, or traumatizing for those holding less privilege.

### **Summary**

As demonstrated in these various findings, although not exhaustive instances, practices and strategies identified through fieldwork observations of feminist technology collectives and open science hardware meetings, are inadvertently in conversation with, and at times almost respondent to, needs identified by engineering education researchers during relational interviews. For example, the use of discussion and electronic emailing lists to consistently keep up conversation between meetings is a practice of the collectives that was almost explicitly named as a need by engineering education researchers. When conversation lags on collective emailing lists there are issues toward mobilizing and establishing the community of practice for future

iterations. Thus consistent engagement was demonstrated as key for continual support, acquisition of resources, collective emotional support, and so forth. For these reasons, they push for incorporating tactics and strategies identified at larger meetings into everyday practice or institutional change (when possible). These are directly transferable ideas that could be implemented to grow change in engineering education.

Little wins for the feminist hacker collectives are reflected in shifting micro-dynamics (such as the language practices in relation to gender) as well as the “personal is political” motif in feminism which comes out in installing the open-source operating system Ubuntu on one’s computer, jail-breaking one’s phone, or gathering with other beginners to install and skill share about free and opensource software. When looking at such shifts as ‘wins’ in the Alinskian sense (concrete, incremental, measurable changes that directly benefit organizing community members), even conversations that establish safe space and change just one mind at a time are considered breakthroughs and important shifts, no matter whether the scale is at a micro-level.

These small shifts may later become large cracks or fissures in the dominant frame against which these groups are organizing. For example, one activity at an OSH hacker meetup resulted in unplanned discussions about comfort, how to establish physically/mentally safe space, the problems of masculinist and competition-based cultures in technoscientific work and research, and eventually led to a monumental change in mindset for a few individuals. But it also set the stage for changing dynamics at the host space and the future planning of restorative healing circles, workshops, and methods in conversation with the participant who was experiencing exclusion, discomfort, and frustrations. Instead of animosity and being dismissive of those who were contributing to an unsafe space, the group worked through differences toward an open (while at times uncomfortable) dialogue that resulted in changing frameworks, institutions, and continuing conversations about how community science practice might move forward with attention to intersectional dynamics of gender, race, socio-economic class and disability.

These practices and this example have implications for establishing space and conversations for discomfort and reconstructing difficult or even violent value-systems embedded in technoscientific and engineering practice within engineering education moving forward – especially in conversation with hopes, needs, and aspirations among those interviewed. Some of these practices around attending to micro-dynamics and acknowledging even small “wins” could be especially beneficial for the engineering education community which is often called upon to demonstrate widespread and lasting change as a direct result of engineering education research efforts. Learning to celebrate and communicate micro-level shifts is a specific organizing skill that can build momentum and support that amount to significant cultural change over time.

This overarching project to which Study 1 and Study 2 contribute has particular intended outcomes toward coordinating and establishing organizing techniques for engineering education researchers. It is through this nascent work that we hope to first identify such possibilities, with

the intention to later enact, and further establish a change-making campaign within the discipline. The implications of visionary futures for how the world of technoscientific practice might be otherwise via the grassroots organizing of feminist hackers and OSH groups is thus fertile ground for thinking through the leveraging of resources, expanding mindsets, tactics for shifting power dynamics, and continuing conversations as a mode toward energizing a movement.

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