"For Girls to Feel Safe"

Community Engineering for Sexual Assault Prevention

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ABSTRACT

This study explores the efforts of two girls to use STEM (science, technology, engineering, and mathematics) knowledge and practice to empower themselves and their peers amid threats of sexual violence against them. Drawing on the feminist construct of intersectionality and social practice theory, we examine how these girls called on intersecting knowledge, practices, people, and scales of activity (different scopes of action) to reclaim space, voice, and peace in the face of violence and fear, scaffolded by adults who became their partners for change.

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Learning and practice are grounded in historical, physical, and contextual location (Bright et al. 2013). In STEM (science, technology, engineering, and mathematics), sociohistorical narratives about who can develop and succeed in these subjects affect learners' understandings of themselves and their possibilities (Calabrese Barton et al. 2017). Narratives about who is positioned or coded as female and what that construction means likewise influences young learners (Paechter 2006). As Kimberlé Crenshaw (1989) argues, such narratives are further complicated by the intersectionality of gender experience in heterogeneous, layered, dynamic realities. Thus, diverse and intersecting contexts, stories, hopes, and concerns frame girls' efforts to learn, practice, and succeed in STEM. Inviting socioscientific and sociopolitical issues into STEM learning may help widen spaces for girls to take up ownership and identities in STEM, and lead to critical action and empowerment for these women as well as their communities.

We discuss the experiences of Keke and René,[1] two sixth-grade girls of color who designed an anti-rape jacket at their local Boys and Girls Club in Michigan, as part of ongoing STEM programming in a youth-designed, equity-oriented makerspace. We explore how they leveraged critically inter-

secting knowledge, practice, people, and scales of activity in and outside of that program to address the problem of sexual violence against young women, especially young women of color in their low-income city neighborhoods. We argue that their critical- intersectional engagement with STEM produced transformative action for their local community of peers, turning often-violent places of adolescent girlhood and STEM tword nonviolent ends.

Considering Young Women, Power, and STEM: Intersectionality across Scales of Activity

Youth have historically been asked to silently accept pain, follow opaque commands, accept perceived injustices, and avoid questioning power (Jenks 2005). Such societal and institutional demands on youth for unquestioning silence can harm learning and development (see Hawkes and Egan 2008). Social structures and institutions routinely hand girls additionally oppressive tasks of prioritizing, internalizing, and taking responsibility for young men's desires, educations, actions, and decisions above their own—for example, when girls are removed from classrooms for wearing clothes that boys define as sexual, or when they are told that their alcohol consumption or physical presence in a bedroom is equivalent to at least partial cause for violence committed against them by men. Regina Rahimi and Dolores Liston's (2009) interviews with teachers on student sexuality reveal how gender double standards always intersect race and class as well. Furthermore, educational bodies have largely focused efforts on policing and protecting female bodies without considering issues of youth agency (Egan and Hawkes 2008; Fine 1988) or justice (Lamb 2010). Despite these obstacles, girls are expected to pursue personal and professional successes in learning and leadership (with or without men), and to uphold and embody the values of their communities as they explore the world. Educators, researchers, and policy makers are especially interested in increasing participation in STEM, where women still hold less than 30 percent of degrees in the United States (and when you take away white and Asian women, that drops to less than 5 percent) (NSF 2015). Efforts to rewrite narratives on topics ranging from sexual existence to educational participation must always include youth as valued thinkers and capable owners of their own bodies and minds.

To problematize this in our exploration of girls designing for nonviolence, we ground our study in social practice theory (Holland et al. 2001)

and feminist writings on intersectionality (Crenshaw 1989). Combining these perspectives illuminates intersectionality across scales of activity. We explore how the girls' positionings as raced, classed, and gendered people shape and are shaped by dynamic STEM and community contexts in their lived-in worlds, drawing lessons from Yrjö Engeström and Annalisa Sannino's (2010) method of looking both in the moment and across setting and time, and from Amanda Kidd's (2016) attunement to networks of symbolic violence structuring women's educational engagement. We explore how girls navigate juxtapositions of real and symbolic violence in STEM and in girlhood through their technological design work.

Intersectionality helps us question assumptions built into STEM learning and practice that marginalize and minoritize young women of color in the United States. The construct recognizes women's experiences as multiple, layered, and intersecting, and gender as always in-movement (see Crenshaw 1989). Preadolescent girls conduct identity work in figured worlds structured by power, privilege, and oppression. They become positioned within a matrix of oppression as gender, sexuality, race, class, and nation intersect (Collins 2000). Institutional histories and norms subject young women of color to symbolic violence that disrupts efforts to develop identities and futures in STEM (see, e.g., Carlone and Johnson 2007). This context gains urgency as the United States embraces increasing antiwoman and pro-violence cultural-political rhetoric, policy, symbolism, and action. Local instantiations of reenergized national racism, sexism, and classism must be challenged in every domain, including STEM, where raced, gendered, and classed contexts dictate opportunities and obstacles (NSF 2015).

Intersectionality also calls for exploring empowerment and disempowerment across both physical and figured spaces—"even within allegedly safe spaces" (Collins 2009: 132). This is where intersectionality across scales of activity is centrally important. We are concerned with how practice develops across activity scales simultaneously and over time, in real and imagined places of STEM, such as in a physical classroom and in the various community meeting spaces layered on top of that classroom (Jurow and Shea 2015). These concerns tie the idea of experiencing geographies of STEM to girls' active work across design boundaries.

As girls move in time and space, they are exposed to, positioned by, and react to a range of people and institutional and cultural forces, as Dorothy Holland and colleagues (2001) have illuminated. Here, local and sociohistorical contexts interconnect as dynamic sites of learning where community members individually and collectively struggle to negotiate relationships

between personal and sociohistorical narratives regarding what normative STEM engagement is (Gutiérrez 2012). Viewing multiple scales of activity reveals how boundaries of formality, expertise, and time change differentially through local positioning over time and space, which helps define who can do STEM, and where and how learning and doing matters.

Research-and-Practice Design Context for Intersectional Engineering Afterschool

As afterschool researcher-teachers, we asked how two youth engineers used connecting and intersecting knowledge, practice, people, and scales of activity to create a technological tool for preventing violence against girls. We used qualitative methods for data collection and analysis, with a descriptive exploratory framework for considering learning and practice in critically intersecting contexts. Data was gathered within an ongoing partnership for researcher-led STEM programming in a Michigan Boys and Girls Club (a community-based club focused on youth development, homework help, and sports for young people from low-income backgrounds). We continue to house STEM programs here because, as the youth explain, it is their "territory," imbued with more youth ownership than, for example, their schools, libraries, or parks. The lived experiences of youth and the particular cultural histories in the club guide our work and support interactions between STEM and youth worlds that might not exist elsewhere.

From 2013 to 2015, 36 youth participated in our STEM program, of whom 11 participated for 2 years (2013 to 2015) and the remaining 25 for 1 year (2014 to 2015). Participants were primarily from grades 6 to 8 (aged 11 to 14), and 64 percent identified as female. Of these, 28 (78 percent) identified as black, 4 as white, and 4 as biracial. The two authors of this article identify as white and female. Program leaders and mentors represented a range of gender and racial identities during this study (for example, white, black, Korean, and Latinx). As others have routinely coded us as white women across our lives, and because of a wide range of inherent privileges and blind spots associated with that, we approach our research and practice knowing the limits of our perspectives within a matrix of oppression that often positions us differently from youth participants. We also approach our work with continual commitment to reflexively unearthing those privileges and blind spots, and to working with the youth we teach, along with their relatives, friends, and wider communities, as

coalition members and comrades in arms against sociopolitical injustice both within and outside STEM boundaries. Finally, nearly all program youth are from lower-income backgrounds (and both authors grew up in lower-income families). This connection has mattered in our relationships with youth and in our youth-adult coalition work toward antiracist, anti-sexist, and anticlassist social justice.

The first author has taught in our STEM program for four years (and lives near the club), and the second author has collaborated with the club (and taught in the program) for a decade (and her children are currently program members). We have built, over time, long-lasting and trusting rela-tionships with club leaders and youth. We spend time in their spaces outside the program, and we bring them into ours, like summer programs and youth leadership meetings at a nearby science center.

This article focuses on participants Keke and René, who officially joined the program in the spring of 2014. The friends and working partners iden-tified themselves as preteen, black and biracial, female, low-income, and interested in STEM futures. We have known them for four years and worked with them for three. While our relationship continues today, their tool dis-cussed here was completed during the 2014–2015 school year. As partici-pants, they engaged in engineering for sustainable communities, a best practices goal promoted by the National Academy of Engineering (NAE 2010) as an incorporation of multiple perspectives and the collective good. Participants used community ethnography to embed local knowledge and practice into engineering design. They collaboratively generated questions, analyzed data from multiple perspectives, and leveraged data toward more complex problems and possibilities. They moved into community spaces to explore social and technical problems in culturally sustaining ways. As they designed solutions in makerspaces, community members of ranging expert-ise shared help, insight, and feedback.

Methods for Data Generation and Analysis

Our ongoing research employs the tools of critical ethnography for conduct-ing research *with* participants instead of *on* or *for* them. Across the 2014–2015 school year, we engaged in participant observation through intersecting roles as researchers, program leaders, STEM teachers, and mentors. We kept field notes twice a week (every session) across the year, to record observations as researcher-teachers interested in scaffolding learning, supporting devel-

opment, and addressing critical concerns. Field notes also acted as purposeful mirrors to recheck and renegotiate our thoughts and actions, which supported critical, reflexive pedagogy and more nuanced data. The authors discussed student progress and group dynamics weekly, to alter programming in response to student needs and interests, and to consider research implications of observations. Youth participants enacted multiple project roles as STEM investigators and designers, and as study co-designers. For example, in weekly so-called conversation groups, youth decided on directions for their investigations and identified what educational and material supports they needed from us. They shared community stories and discussed how to address community needs through engineering design. These ideas became central to our intersectional analysis.

We collected artifacts of youth work throughout the year, including sketches and notes, presentation slideshows; their published blog posts, photos, and videos; and their completed physical prototype. We hosted what we called individual artifact interviews midyear and at the end of the year to engage youth members in reflection and critical discussions on the steps of their design process and on how their completed work products held importance for them.

Following Anselm Strauss and Juliet Corbin (1998), we coded data using a constant comparative method for analysis grounded in the qualitative data, using codes we developed as we completed analytical passes. First, we read field notes, transcripts, and student notebooks, noting what people, actions, and ideas featured in moments that Keke, René, and/or adults named as important to their design process. The second pass focused on how and why Keke and René used connecting and intersecting knowledge, practice, people, and scales of activity, in relation to previously identified important moments. We met weekly to discuss emerging codes and analytic memos across data sources, using our theoretical frameworks (social practice theory and intersectionality) to uncover how the girls worked across critical connections and intersections over time. Actions identified in this second coding pass (see Table 1) led to selective coding categories and example events for a final round of analysis and presentation. In this last round, we organized narratives on Keke and René's engineering design process, including how action connected across knowledge, people, practices, and scales of activity and how efforts resulted in expanded outcomes for intersectional empowerment.

Findings

Our findings integrate descriptive and secondary analysis. Our descriptive analysis presents Keke and René's journey of designing and prototyping, through critical-intersection STEM engagement, an anti-rape jacket that was fashionable and functional. Our secondary analysis uses their case to make two main points about how and why these girls worked to arm themselves and community peers with critically designed tools for empowerment over threats of sexual violence, through the opening of boundaries between community, STEM, and action. First, they integrated multiple intersections of knowledge and practice across context to develop a technological solution to protect and empower girls like them. Second, the outcome of their efforts expanded beyond their technological tool to what that tool represented and symbolized for them, and what it allowed them to do.

Critically Investigating Safety for Young Women

In October 2014, members of our program decided to explore the theme of community safety, agreeing to use it as a framework and purpose for their work through the year. Keke and René joined their peers in conducting a community ethnographic investigation of this topic as a first step. We helped them design an open-ended survey that they shared with community members to solicit experiences and ideas about safety. They asked people in their afterschool organization and the surrounding neighborhood what safety issues concerned them the most. Then they invested a few weeks in organizing, analyzing, questioning, and debating the data they collected (including conversational data and formal survey results). They supplemented and critically compared that data with their own experiences and the research they were conducting online.

Keke and René were concerned and intrigued during this process. They noticed a pattern in 62 community responses they had gathered: 74 percent of respondents were most concerned about personal safety while "commuting." Youth and teen respondents shared fears of being personally harmed by people while walking alone in the dark. Adults more often identified fears of getting hurt by cars. They noticed that open-ended responses specifically highlighted walking in the dark: "walking home from the club at night," along with "walking in the dark where there are no street lights," and "guns, rape, and violence." Keke and René connected this last survey response to a local news story they had seen earlier that year about a young black girl who

had been sexually assaulted in their area. As young women—black and bira-cial, respectively—both recalled conversations they had with each other about their concern for their own safety and the safety of their friends and siblings. They decided to conduct more research into this chilling risk. Their findings on rape in their community alarmed them and became the foundational rationale for their work, including the statistic that more than half of African American girls are assaulted before the age of 18. They decided to make a jacket that would specifically address this need by providing a safety alarm, while also remaining, as they described it, "affordable, attractive, and secret."

Their afterschool work made visible the problem of rape against young African American women in ways that statistics on the Internet do not. Vio-lence against girls became a continual component of their conversations with peers throughout the year. For example, when another girl in our pro-gram complained that her ex-boyfriend was bothering her, Keke took the opportunity to leverage her developing expertise about violence against girls into a local leadership position, from which she offered strongly worded support and advice for her female peer community member. The girls also inquired about our adult relationships and how our romantic partners treated us, drawing from our knowledge as fellow supportive women. In moments like these throughout the year, the girls positioned themselves as spokespeople and investigators for empowered young women in the middle of our STEM space of learning and practice.

In January, the youth presented their developing ideas to a range of peo-ple (and perspectives) at a mid-design community feedback event. Keke and René faced a packed crowd of youth and adults at their community organ-ization, including a panel of experts—an older teen club mentor, an adult club leader, a university engineering professor, and prototype developers. They presented their problem space statistics on violence against women, young women, and young women of color, and their concerns about risks that their friends and family members who live in their low-income com-munity might face, stating, "Michigan has [the] third-most rapes" and "most [rape victims] are under 20 years old." They discussed their process of data collection and analysis and their decision-making that expanded and com-pressed that problem space (including power circuit needs and style desires). They then presented their idea for a stylish anti-rape jacket, a jacket that appeared normal but concealed an integrated circuit to trigger a loud alarm, in a video they made as talking heads in front of a special effects background. This presentation, like their design idea, was the culmination of work com-prising several intersecting strands of knowledge and practice.

Keke and René's presentation ended with several questions for the visiting experts, like "How can we wire the speaker, button, and battery inside the jacket?" along with "Can we use solar panels?" and "Does jacket length affect its use?" They integrated the feedback and follow-up questions they received that day, like "Where will your button be located?" and "How loud will your alarm be?" into their larger investigation and design process, pushing themselves to optimize their design to attend to technical and social constraints and needs. In each round of construction, they had friends try on and test their jacket, chatting about its components and its look while seeking critical feedback. At the end of the school year, the girls faced another packed crowd with another slideshow. In this important spotlight, Keke and René triumphantly held up a stylish, bright red jacket—their completed, working prototype.

Figure 1: The anti-rape jacket.

The Final Prototype

Keke and René's jacket is fashionable, and from the outside, no one would realize the technological power it holds (see Figure 1). Each aspect of the jacket was painstakingly debated, constructed, tested, and refined within the critical STEM and community contexts that framed and aided their investigation, providing them with purpose and perspectives for considering design criteria, constraints, and consequences. The jacket's shape, its bright

red color, its short length, and the invisibility of its alarm resulted from many design iterations punctuated by debates over community data patterns and testing results. Figure 1 (upper left) shows how the girls hid the alarm trigger and power source inside the jacket. Securing parts with duct tape instead of permanent stitching allowed them to move components around as they tested functionality, ease of use, and volume level. The on/off trigger connects to an upper exterior jacket button, which looks and performs exactly like the other jacket buttons, but is connected internally to the alarm circuit (Figure 1, lower left). This part of the design took several weeks and was a point of extreme frustration for the girls, further exacerbated by loud accidental alarm blasts every few seconds during some tests. Since their trigger design was novel, program adults were truly co-learners in this process, and continual emotional encouragement was important for everyone involved. Their goal for change served as a rallying cry that helped us survive that challenge together, and we emphasized embracing failures as steps toward success. The girls described their eventual discovery of a creative solution for their trigger connection—involving copper foil and insulating glue—as one of their "biggest victories" and one of the "most important" design elements of their anti-attack jacket.

The alarm itself is a piercing, high-frequency, and high-decibel electronic beep. The girls originally wanted their alarm to yell "help," but to limit their technical challenge, they instead tested a wide range of standard alarms. After testing several other alarms, they settled on one particularly shrill alarm that caused everyone around them to stop all action—their intended response. Figure 1 (lower right) shows Rene lifting a secret pocket below the collar, revealing the power source. A flexible solar panel's wiring tucks into the fabric, leaving a center panel exposed on the shoulder area, to catch solar rays as the wearer walks during daylight (Figure 1, upper right). The rechargeable battery stores that energy for nighttime use, so the wearer, as Keke and René explained, "never has to worry" that the battery might run out.

Keke and René's Analysis of Their Design

With their project completed (and our program ending soon for that school year), Keke and René reflected with us on their prototype, their community and tech-informed investigation and engineering design work, and their program participation. Almost every statement in their end-of-year interview can be traced to multiple sources of evidence the girls gathered and analyzed,

revealing the intersectional nature of patterns they drew across their investigation and design process.

> René: I'm a hero … Because I feel like my invention saves a lot of people … It saves a lot of women because of the jacket; it's to help girls when they're endangered.
>
> Keke: I want to help those girls, to help them to not do things they don't want to do, and to not … have their bodies exploited if they don't want to.
>
> Day: Where did you hear about that word?
>
> Keke: Exploited? On the Internet.
>
> Day: When you were doing research for this?
>
> Keke: Yup. I learned a new word, guys.
>
> Day: … How'd you come up with this idea?
>
> Keke: Because too many females in this world get raped—44 percent [shakes her head].

Here, Keke referred to a statistic they kept encountering as they conducted preliminary research, data that drove their investigation. In the United States, 44 percent of reported sexual assaults target individuals under age 18 (see, e.g., Chemaly 2015). This was Keke and René's age range.

As we discussed their completed prototype and the design process that produced it, Keke and René exuded ownership and strength, smiling and caressing their jacket as they pointed out its most important components. They voiced their expertise with agentic power.

> René: If you're in danger and someone is trying to kidnap you … or someone is trying to rape you or something like that, you can start running and press the button, and people might hear it and call 911 or try to help you.
>
> Day: Yeah, so does it work yet?
>
> René: Yes, it does.
>
> Day: And is there anything special I should know about it? What are some highlights of it? Some really cool parts about it?
>
> Keke: It's a jacket.

Here, Keke addressed an issue to which the girls were acutely attuned. Most marketed personal attack prevention tools look like personal attack prevention tools. Many they found were designed as keychains or other handheld objects. Keke and René did not believe these designs could sufficiently address their intersecting concerns related to contexts that required stealth in appearance and functionality. To address these concerns and to act on that product gap, they developed design criteria from intimate knowledge of social situations in which they would want to keep some self-defense information a secret, like when attending parties with peers.

First, they wanted wearers to not feel encumbered by their tools; Keke and René understood that girls want to look and feel cool, confident, and normal, a design constraint based partly on their target consumer's age range and the strongly experienced needs for social belonging that are heightened during that critical period of socio-emotional development. While Keke and René did not share this understanding with such developmental psychology jargon, they did share it in terms that illuminated their attunement to critical community contexts of importance to their peers.

Second, they labeled currently available products "lame," not only because they looked boring but also because their lack of stealth in design could put their users in danger. For example, the plain visibility of an anti-attack alarm keychain makes it vulnerable to being grabbed or broken by a stronger attacker. Keke and René acknowledged the user's potential need to travel in close proximity to people in social spaces without revealing the self-defense tools on the user's body—what they called the need to keep one's defense plans "under the radar." In response, René added a further claim about their "special" engineered components.

> René: You can't see the button. The button blends in with all the rest of the buttons, so nobody else would know.
>
> Day: And why is that important?
>
> René: Because if they see it, they might try and break it off. If somebody found out there was a button right there and they were trying to attack you, they might rip it out.
>
> Keke: They'd try to break it.
>
> René: And then they'd just take you.

A Critical-Intersectional Engagement with STEM

Intersecting Scales of Activity

Keke and René multiple integrated, intersecting bodies of knowledge and practice across context to develop a technological solution to protect and empower girls like them. Their investigation drew from and leveraged several layers of data they produced through engagement in intersecting modes of practice.

Table 1 outlines the ways Keke and René identified and responded to the intersecting nature of violence against girls, as well as how a technological tool might help prevent it. For example, their emergent theme of "quality requirements" came out of several rounds of conversation on community

symbols of economic power through fashion, informing their decision to invite peer expertise in testing and decision making to produce a design that protected users against gendered and classed judgment as well as violence.

Table 1: Content Analysis of Keke and René's Actions to Address Intersecting Themes Critically

Investigation and Design Themes	Examples of Action
Safety concerns in geographic context	Surveyed community about safety concerns.
Violence against young women broadly	Connected community analysis to national data.
Violence against young women of color	Situated online data on violence with race and age
Mobile anti-violence tools	Searched for modifiable alarms
Hacking wearable electronics	Dismantled alarms with peers
Quality requirements within socioeconomic norms	Tested with peers for look and feel
Community knowledge of defensive secrecy	Debated design consequences for effectiveness.
Fabric construction, circuit design, testing	Effected the construction and tested cycles for usability and efficiency
Communicating findings to empower community	Did presentations and slideshows, wrote blogs, and held conversations

Through bringing together different knowledge, practice, people, and scales of activity, Keke and René acted for themselves and others against violence that seeks to strip away power, agency, and voice. Their committed engagement produced transformative action specifically because that action addressed multiple scales of intersecting needs. Their prototype was protection against violence, proof of STEM expertise, and fully functioning apparel that was informed by and supported peer efforts to achieve social belonging through fashion performance. The girls met complex peer needs for a secret protection plan that does not interfere with social belonging bids but is ready for emergencies. They also met their own complex needs to take back power in STEM and in sexuality, both in the moment and in socio-historical context (Calabrese Barton et al. 2017).

Toward these goals, their critical-intersectional engagement offered them a unique way to recognize their own agency and how their community had their back. Keke and René's final prototype was a result of community

engagement, co-learning, co-creation, and co-testing. It was built from intersectional identities and intersecting goals. It was a product created with, by, and for community. But it was also fully theirs, a lasting representation of Keke and René as a legitimate force. Two years later, the jacket is still displayed at the Boys and Girls Club, where it has inspired many youth conversations around topics spanning sexual violence, personal socialization and sexual health goals, female empowerment, reproductive rights, and human rights in general. For example, Keke recently hosted an in-depth discussion about her jacket with two younger program members who often discuss how puberty affects their school lives and their gendered interactions. Afterward, these members stated their intention to create their own protective clothing design as their next STEM project.

Intersectional Empowerment in Practice

The outcome of Keke and René's efforts was not the technology per se, but rather what that technology represented for them as a tool of female strength and brilliance, as well as what it allowed them to do. The young women used their work to position themselves as teachers and experts in a local context. They shared their dedicated learning and practice with others, leveraging their developing identities as experts and teachers to become leaders and change makers with STEM.

Through their work, Keke and René grew to re-envision several layers of their experience. They saw themselves, the situation of violence against girls, and their possibilities for critically enacting power and agency in STEM differently. This was internal transformation. They became their own heroes, taking on positions as leaders and solution makers in a situation they feared could deliver them into victimization. Their engagement transformed as a result of their license to produce new knowledge and action that mattered to them and their community. For example, they moved from guided participation in the program to leading peers and giving advice to newcomers.

They also grew to see how their community of peers and adults were present in and committed to their struggle for power and voice. This included comments of encouragement and concern like "I can't wait to hear what you all come up with," "I love your idea," and "We really need these in my neighborhood." They also gave voice to peers by hearing their concerns and incorporating them into their work. For example, they structured their midyear presentation not for assessment or approval from the expert panel but for knowledge sharing and community crowdsourcing across the audience, which led to peers sharing feedback at the same time as the panel.

In this way, they empowered other girls while gaining recognition and support for their expertise in STEM and in their community. The topic of girls' safety was a powerful intersectional platform for this work in coalition.

Keke and René's critical action exhibited the power of reclaiming and relocating STEM engagement for results that matter. This opens up new possibilities for designing and supporting STEM learning that supports girls' actual negotiations and navigations of life. For example, Keke and René's next project after their anti-rape jacket was a redesign of their city's public transportation heating system, a direct result of their frustration with riding cold public buses in the middle of winter. And the two younger girls whom Keke recently counseled are currently designing a greenhouse to solve their problem of limited access to fresh fruits and vegetables. The powerful STEM learning happening in our program would not be the same if we removed our commitment to see their plans through to fruition for change. This is why we commit hours to creating strong partnerships with other adults in power like parents and community leaders, local entrepreneurial advisers, city politicians, and local content experts who can assist with change. Researcher-teachers can better support youth agency in learning when they recognize young people's critical perspectives and intersectional positions as legitimate and central to that learning. Then, they can help youth take the next step by using their learning to fuel critical action for change.

Keke and René took critical-intersectional action and saw its powerful results as improvements in their lives. As Keke explained, "You don't have to change yourself to be a different person … [You] don't have to do things that you don't want to do that other people are telling you to do." By acting to change their context, the girls created a space of possibility to develop themselves on their own terms.

Conclusion

Young women of color have agency and power in society and STEM, and they seek ways to use it. At the same time, they operate within social and institutional structures of adult, white, male power that make enactments of youth agency complex negotiations and navigations. Keke and René illuminated the urgency of recognizing girls' critical perspectives and power as legitimate and central to action. The girls intersected knowledge, practice, people, and scales of activity to support their efforts to empower themselves and their peers amid threats of violence against them. Their transformative

action goals galvanized their STEM work. Their efforts reclaimed space, voice, and peace in the face of violence and fear, scaffolded by adults who made themselves open to listen, learn, and act in partnership for change. When girls participate critically in communities that invest in their efforts to enact agency over their lives and futures, they can do more than build STEM expertise for themselves—they can achieve and claim ownership of their own identity development and empowerment.

Acknowledgments

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Note

1. These girls selected their pseudonyms.

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