



Designing for Belonging and Becoming in an Afterschool Tinkering Program

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After spending the morning gathering materials—butter paper, markers, wooden stands, power drills, screws—and discussing our expectations for the next hour and a half with students, we enter the afterschool center, situated one block from city hall and another block from one of the city's oldest public housing neighborhoods. Today is a showcase day, where participants will share their foam derby cars with other club members and staff.

Walking in, we continue a conversation we've been having from the beginning of this project: What modifications should we make to support youth decision making? What else can participants learn to do with the scroll saw that would advance their work? Have our design prompts proven inclusive of participants' interests in automobiles, fantastical narratives, the workshop materials, and each other?

Now in the clubhouse, we're informed of a schedule change that adds 20 minutes to setup and reduces time for the showcase itself. Facilitators and students quickly adjust, using the time for finishing touches. Some children yell for specific tools or materials; others pause to revise their presentation plans. Anticipation and anxiety build as facilitators rush to set up the ramp for demonstrating the foam cars. Then clubhouse staff announce another unexpected change: We now need to share the gym with a basketball practice scheduled by a staff member who no longer works here. This additional space constraint leads to a heated conflict between Iris and the rest of her group about whose projects deserve more visible placement. In light of these new predicaments, we abandon the

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showcase altogether. Instead, we improvise responses to the conflicts among participants.

This scenario may sound familiar to afterschool educators; it reflects the precarious and fluctuating circumstances many negotiate, regardless of how carefully they plan. Afterschool centers are known for being flexible spaces where young people enjoy freedom of talk and movement, build long-term relationships with peers and staff, and engage in choice-based programming that supports them in exploring their interests and emerging identities. These conditions are ideal for connected forms of learning that differ from those promoted in traditional school environments (Ito et al., 2013).

According to sociocultural theory, learning in socially and intellectually supportive spaces promotes socially situated identity development, which is essential for a sense of belonging to a community of learners (Gee, 2001; Lave & Wenger, 1991; Rogoff, 1994). Historically, afterschool programs have been purposely set apart from schools in terms of practice, pedagogy, and philosophy (Halpern, 2002; Heath & McLaughlin, 1994). However, the many factors that put extra pressures on children and staff, like those described in our opening vignette, can make it difficult to maintain these distinguishing features. Staff may fall back on school-like practices of behavior regulation that constrain the ability to design for freedom and belonging.

This article examines efforts by an afterschool tinkering program to prioritize belonging and transformative inclusion. By *transformative inclusion*, we mean including each person in a space, accommodating that person's cultural practices and history, and making efforts to transform the norms of the space to better suit those practices and that history. We look not at moments of success but at moments when the program's core values were challenged, as in the vignette, and on what facilitators did to keep the program design responsive. The discussion focuses on alternatives to the kinds of behavior remediation that lead to the exclusion of some children.

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We identify three areas of program design where elasticity is necessary to foster a sense of belonging among all participants. Educators must strike a balance between flexibility on the one hand and, on the other, the norms and structures that help young people to feel supported. The image of a rubber band serves as a metaphor for a community of mentors and learners bound by a commitment to transformative inclusion. The rubber band goes through states of relaxed elasticity, moments of pull and tension, and sometimes even twists as young people and educators negotiate room for growth, safety, exploration, and connectedness. We hope this image can help educators explore solutions to the everyday predicaments that arise in afterschool environments.

Program Context

The Tinkering Afterschool Program is a collaboration between the Exploratorium, a science center in San Francisco, and a local afterschool organization. Science center staff, in conversation with afterschool staff, develop and lead weekly tinkering workshops at afterschool centers in two working-class neighborhoods. Tinkering in our context is conceptualized as an inquiry-based creative practice where arts, STEM (science, technology, engineering, and mathematics), and historical and vocational crafts are equally valued. Program participants design and build artifacts such as stencils for custom t-shirts, wooden ball mazes, and stylish race cars.

Participants range in age from six to 12 years old; cohorts are typically grouped in closer age ranges.

Science center staff design and staff the tinkering program. At the time of data collection, Meg Escudé was the program director; she established the partnership between the Exploratorium and the afterschool organization in 2012 and led the tinkering program at one of the two sites until 2019. Jake Montano led the program at the other site. Meg and Jake collaborated with the afterschool education directors at their sites, who sometimes joined as co-facilitators as well. Edward Rivero, a PhD candidate,

was engaged in participatory design research at Jake's site in 2018–2019. The program also employed three to five teen and young adult facilitators at each site for each weekly workshop.

The program is explicitly organized to prioritize the equity and dignity of participants and their communities. Facilitators carefully consider the cultural, political, and historical context and possibilities of the projects (Vossoughi, Hooper, & Escudé, 2016). Moreover, they pay close attention to how relationships are built among program participants. The pedagogical intention, based on research (Cole, 1996; Rogoff, 2003), is for adult and teen staff to support and prioritize youth agency and creativity while engaging in joint activity. Facilitator engagement and co-investigation positions expertise and knowledge as being distributed among both learners and teachers. Facilitators can urge deeper investigations and learning in the moment than would be possible if children worked autonomously (Vossoughi, Davis, Jackson, Echevarria, & Muñoz, 2019).

Program staff put each tinkering project through a lengthy process of development and iteration before introducing it in the program. They also engage in reflective iteration during and after implementation. The tools and materials used are authentic, recognizable, and economically accessible; planners avoid projects in which only adults can use the tools. Each workshop day begins with a circle discussion that both introduces the topics and tools of the day and builds community. Then participants have about an hour of workshop time, followed by cleanup. The site team, including teen facilitators, meets after each session to discuss successes, tensions, and ideas about how to support youth the following week.

Methods

During the 2018–2019 program year, we gathered data including field notes, artifacts, observations, photographs, video, and interviews. Drawing on notions of the material and ideal qualities of artifacts from cultural historical activity theory (Cole, 1996; Pea & Cole, 2019), we paid close attention to the design decisions children made when they deviated from the activities designed for them.

A participatory design research approach allowed

us to challenge power hierarchies embedded in a paradigm that distinguishes “the researcher” from “the researched.” As suggested by Bang and Vossoughi (2016), we incorporated educators, administrators, community members, and youth throughout the research process. This research approach draws on a genealogy of design-based research, specifically social design experiments (Gutiérrez, 2008; Gutiérrez & Vossoughi, 2010; Gutiérrez & Jurow, 2016) and participatory design research (Bang & Vossoughi, 2016). Because of our emphasis on power relations, these two design-based research approaches informed how we could create learning ecologies that privileged the knowledges, histories, and cultural practices of all stakeholders in the tinkering program.

Features of Design for Belonging

Our examination of the tinkering program revealed three areas of design where flexibility can help to foster belonging:

- Maintaining curricular and pedagogical elasticity
- Practicing transformative inclusion
- Balancing organizational and structural priorities

Maintaining Curricular and Pedagogical Elasticity

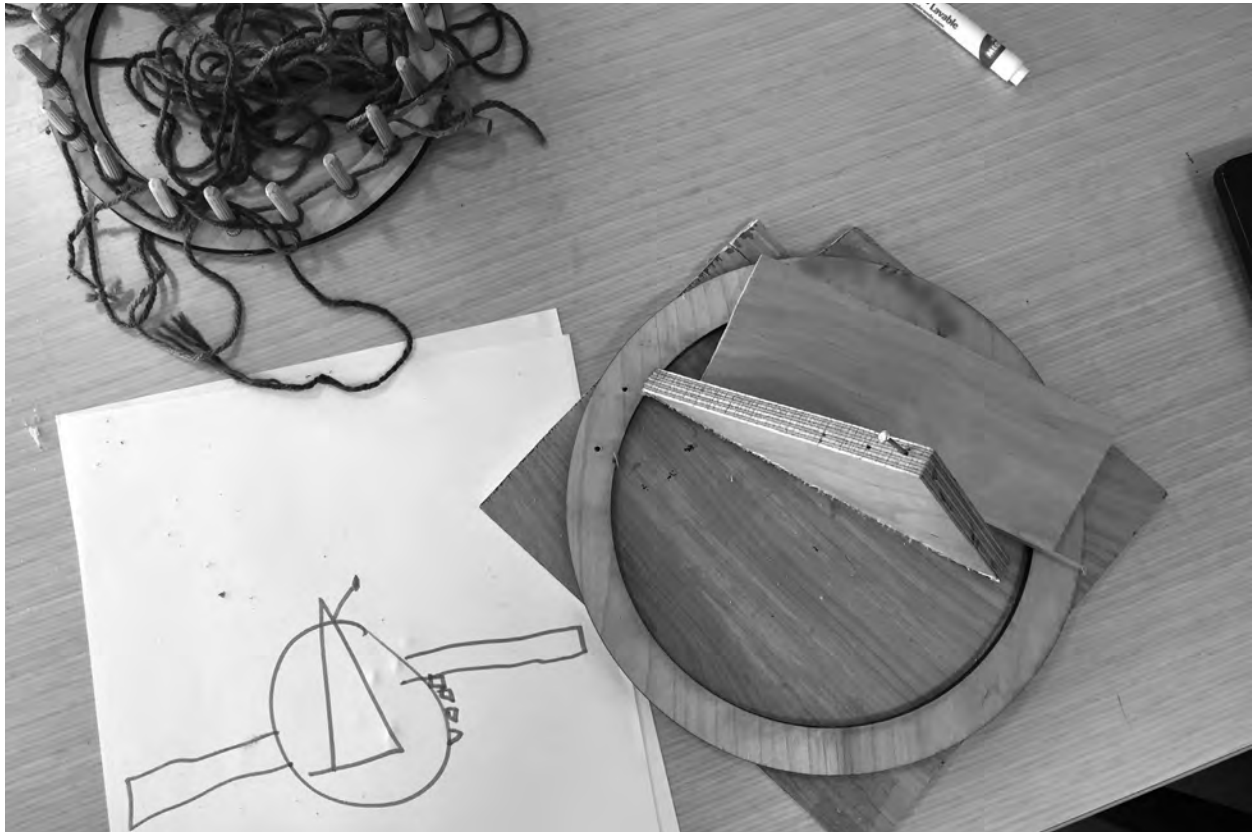
Tinkering programs are marked by an abundance of tools and materials that supply the creations and support the curiosities of participants. We have noticed that making a wide variety of materials available supports expansive creativity. A well-stocked tinkering space is essential to sustain the diverse approaches young people bring to their creations.

However, the realities of packing tinkering materials in and out of a room shared with homework tutors and other club activities means that facilitators have to limit the contents of their crates to the things they anticipate will be most relevant to the projects and concepts being presented. When participants are

inspired to think beyond the boundaries—and the tools and materials—of the activities designed for them, tensions can arise. Ideally, facilitators and participants improvise a balance between curriculum structure and youth agency. This negotiation creates opportunities to learn in a dynamic third space (Gutiérrez, 2008) in

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Figure 1. Top left: a circle loom. Bottom left: Damon's drawing. Bottom right: Damon's bird feeder, in progress.



which learning is guided both by educators' design and by participants' interests.

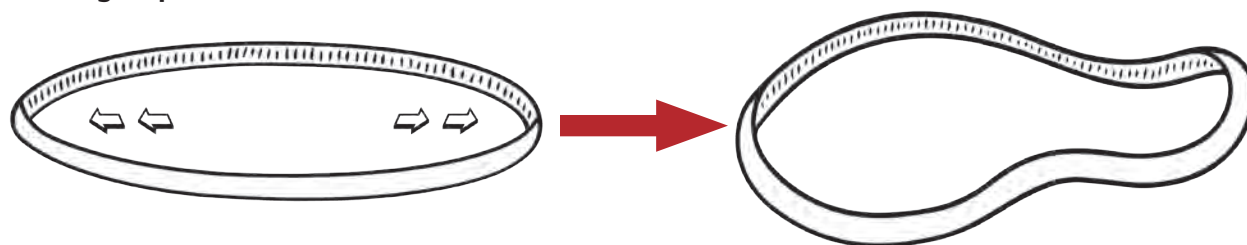
The incident of Damon's loom illustrates such a shift. (All participant names in this article are pseudonyms.) The session centered on the creation of wooden looms for weaving. Facilitators introduced a variety of traditional loom models so children could choose one to create or to modify toward a new design. Damon, a seven-year-old African-American boy, took the project in a completely new direction. He started with a pre-cut wooden ring, intended as the basis for a circle loom, and began to nail it onto other pieces of wood. Thinking he didn't understand, facilitators attempted to correct his work. Resisting their prompts, Damon requested wire and shapes of wood that were not available because we hadn't imagined they would be needed.

When Meg realized Damon had an intentional plan, she encouraged him to draw a picture of what he was creating. Though drawing and talking, he revealed that he was creating a bird feeder. The wooden ring would contain the seeds, and the wire he was requesting

would create a perch for the birds. In a video interview on the day Damon finished his project, Meg asked him to talk about his bird feeder. He said, "I thought that I would make something else, but I was creative, and I said in my brain, 'What would birds do if they needed food to survive?'" The following week, Meg made a poster with photographs of student work from the past weeks and asked the students to write captions. Damon's caption for his project (Figure 1) was "I made a bird feeder for the birds and I was creative."

In using the word *creative*, Damon framed his deviation from the intended activity positively within the program's values. Although he initially met resistance, he was determined to repurpose the materials and tools toward a new project that had personal meaning. The image of a rubber band helps to illustrate what happened. In Figure 2, the first rubber band shows the strain created when Meg and Damon pulled in opposite directions. The second shows the relaxed state that resulted when they worked through the tension, settling on a new plan that included Damon's interests.

Figure 2. Damon's determination to reinterpret the planned curriculum initially creates tension with the educator's plans. The tension is relaxed when his project is accepted as part of the group's activities.



When the rubber band is relaxed, there is room for movement. When facilitators accept participants' agency or resistance, the parameters of the space can shift without creating strain, as illustrated in Figure 3.

In workshop environments, students often draw inspiration from each other's work. Giving Damon

that they were coming up with techniques with which the facilitators were not familiar. Jake began a practice he called "Hey, Everyone!" When a participant found a great way to achieve a task, Jake would announce it to the group and encourage other students to come and learn. Though this was originally an improvised

Figure 3. In a relaxed state, the rubber band's perimeter can shift freely in response to the unrestricted agency of participants.



permission to shift the project gave implied permission to the whole group. The resulting transformation opened new possibilities for all participants. It also interrupted a potential cycle of behavior remediation that can catch learners when they are seen as being off-task. The shift in Damon's position from being *off-task* to being *creative* gave him a path to belonging: He could stay within the perimeter of the rubber band rather than pulling against the edges or being removed entirely.

Damon's story is an example of how one student's determination redirected the purpose of the activity. We also saw examples of whole-group approaches shifting in response to participant interventions. For example, to introduce a new computer program to be used for creating stencils, adult and teen staff anticipated that participants would need extensive instruction. They planned to take turns teaching the needed skills during circle times over several days. However, during these presentations, participants were restless and eager to start working. The facilitators responded by ending the circle earlier than they had planned. As participants began exploring the software, facilitators observed

response, the practice became an established approach for working with complex tools or technologies. The design we use now provides just enough instruction for participants to get started and then allows them to add the expertise they develop during their own exploration. This practice encourages participants both to see each other as resources and to build identities as intelligent learners.

Practicing Transformative Inclusion

Often the tensions in afterschool environments come from personal conflicts between young people. Experienced afterschool staff have a wealth of approaches to preventing and resolving such differences. The approach we highlight here supports transformative inclusion, in which adults seek to remediate (Gutiérrez, Morales, & Martinez, 2009) the structures in which children find themselves rather than asking children to change their participation. In the opening vignette, a moment of interpersonal breakdown between Iris and the other participants derailed the showcase of student work. How facilitators handled Iris's difficulties in working with

others and the shifts that resulted illustrate the power of transformative inclusion.

When Iris, an eight-year-old White child, first joined the tinkering program, the clubhouse staff informed us that she often experienced conflicts with other participants and encouraged us to help shift those dynamics. We soon saw that Iris had difficulty collaborating with peers. For example, when Iris was paired with Sofiya, an eight-year-old African-American and Latina girl, for a collaborative marble-run activity, Iris constantly dismissed Sofiya's design ideas and pursued her own. Eventually, Sofiya exclaimed to the facilitators that she was "being forced to be Iris's assistant" and that she just wasn't "good at marble machines." In an example of how children co-construct perceptions of competence and belonging, Iris's actions created a context in which Sofiya felt incompetent and excluded. Jake talked with both children, who agreed to be split into new pairings. Following this change, we took time in debrief and planning calls to come up with ways to enable Iris to participate with others in more productive ways.

Mid-semester, Iris played a key role in the conflict over the display of projects for the foam derby showcase described at the beginning of this article. As facilitators were setting up the derby ramp, Iris was so upset over not being able to help that she destroyed her own project. Later, she decided to present the project of a child who had left early. Iris said she was fascinated by the design of this project, but other participants questioned the legitimacy of her presentation and of her attempts to place her borrowed project in the center of the display table. When the group was told that it would need to share the gym with another program, tensions heightened. The conflict escalated to yelling. Two clubhouse staff members joined tinkering program facilitators in efforts to resolve the issue, but the result was confusion and conflicting signals. When a participant walked away in anger, Jake made the choice to invest in resolving the conflict. Those efforts took the rest of the program time, so the showcase did not take place.

The following week, Jake and teen staff led a discussion about what had happened, beginning with Jake's reminder that the tinkering program is about

"creativity, growth, and skill building, and not about grades or tests." Jake asked participants to share ideas about making future showcases more successful, using "I" statements rather than "you" statements. He modeled this self-reflection by questioning his own time management during the showcase and then voiced a commitment to manage time better.

What followed was a pivotal discussion. Participants reflected on individual behaviors and made commitments to better support each other in the future. During this conversation, Iris reflected on how she could work on collaborating with others more effectively. She also took this opportunity to remind everyone that she preferred to go by "Frankie." She had made this request before, but staff had

not understood it to be serious. In the context of this circle discussion, with its atmosphere of respect and community support, Jake understood that the request carried weight. Jake, who identifies as queer, is actively engaged in advancing efforts to expand conceptions of gender identity and to eliminate otherness. He suspected that Frankie's choice of a gender-neutral name could be significant. He later communicated privately to all staff that they should honor Frankie's chosen name.

From this day on, Frankie's participation in the program shifted. Educators noticed that Frankie was more willing to ask for help in respectful ways. Though she still showed a preference for working alone, her interactions with peers were less likely to lead to conflict. We wonder whether Frankie's public commitment to change may have helped in repairing relations with participants like Sofiya whom Frankie had marginalized. Furthermore, by insisting on her name change, Frankie helped us transform the social environment into one that explicitly affirms the evolving identities of young people.

The sustained tension that prevented a showcase from happening was a challenge, in the short term, to transformative inclusion. The change from a state of tension to one of relaxation, as in Figure 2, was a long-term one, facilitated by both improvised and planned decisions by educators who prioritized resolution of relationship issues over accomplishment of planned

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activities. The showcase could have been carried out if Frankie and others involved in the conflict had simply been asked to leave the room. This move would have relieved the tension, but it would have broken the perimeter of inclusion. Jake's choices during the showcase and the commitments that arose during the circle time he devoted to finding solutions show how facilitators can design activities to achieve, in the terms of Bang, Warren, Rosebery, and Medin (2012), relational rather than objective ends. Circle time became a discursive space in which all members of the community of learners could hold each other accountable and develop deeper working relationships.

Our commitment to position young participants as co-designers of the space in the interest of transformative inclusion enabled us to think about how to design for relational equity (DiGiacomo & Gutiérrez, 2016). A long-term view enables facilitators to negotiate tensions with elasticity. Prioritizing inclusion and accepting the tension that goes with that choice can lead to growth and becoming for participants and for the space itself.

Balancing Organizational and Structural Priorities

The Tinkering Afterschool program is a collaboration between the Exploratorium and the host afterschool organization. Balancing the needs and priorities of the two organizations can be challenging. Because science center staff come in only once a week, they rely heavily on the site education directors for important context about center activities and about the children themselves. When the afterschool center staff join debriefing meetings or midweek phone calls, reflections and planning processes are profoundly informed by their knowledge of the children's home lives and of their relationships at school and with peers.

Even with these opportunities to share perspectives, there are still mismatches in the priorities of the two organizations. A common tension occurs when afterschool staff withhold participation in the tinkering program, which the children see as special, as a form of behavior remediation. For program

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facilitators, excluding some children contradicts the value of transformative inclusion. Our next example illustrates how the staff of both organizations collaborated to resolve this contradiction in the case of Andre, a 12-year-old African-American child.

Though Andre was a regular tinkering participant, clubhouse staff prohibited him from participating at one point because of arguments he had with peers and staff. Still, he often entered the room while we were setting up, offering to help and asking if he could participate.

Feeling caught between our own value of inclusion and the norms of the clubhouse, we requested a special meeting with the afterschool staff.

In this meeting, we learned that Andre was experiencing hostility from peers stemming from recent shifts in gender expression. Clubhouse staff had regularly seen him trim swatches of fabric into skirts or adorn blazers with patterns—only to stop suddenly when his older brother walked into the room. They believed that Andre was drawn to the tinkering program in part because Jake is a queer man of color who performs in drag and who supported Andre's experimentation. We thought that the hostility Andre was encountering helped to explain why he was behaving in ways that were getting him in trouble. Recognizing the intention of staff to protect the safety and respect of the clubhouse community, we proposed to support the education director's accountability measures in ways that reintegrated Andre into the program rather than excluding him. The director's measures included, for example, daily reminders of behavior expectations for Andre. Eventually, the director told us, she saw that she could step back from these measures because Andre and Jake had established a strong rapport. Together with other positive changes in Andre's life, this rapport enabled Andre to participate regularly with much less conflict with clubhouse staff.

Our final example recognizes complexity in what might otherwise seem like unrealistic idealism in advocating for transformative inclusion. Sometimes afterschool staff do have to remove children from group activities, particularly when safety or wellness is at risk.

In one such moment, Lewis, an eight-year-old African-American boy who often experienced bullying, was having a particularly emotional day. As the tinkering work got going, he started crying and lightly hitting his head with his fists. The clubhouse director spent some time talking with him to encourage him to re-engage. When that didn't work, he chose to pull Lewis away from the program and into his office to cool down. He offered the boy something to eat and an opportunity to talk about his day. When Lewis was ready, the director brought him back to the tinkering room, where children and staff were cleaning up after the day's work. Lewis was excited to see the animated drawings his peers had made. His enthusiasm resulted in an impromptu showcase in which the children proudly demonstrated their creations. Besides creating an opportunity for those participants to gain recognition for their work, the director's decision to bring Lewis back to the program at the end of the session enabled the child to quickly reintegrate into the space and achieve a state of belonging. If the program space is a rubber band, the perimeter was not broken; rather, it was folded in two, as in Figure 4, so that Lewis could still belong to the program community as he worked through his emotions in the director's office.

This example shows that belonging and transformative inclusion can expand to encompass the norms established by afterschool educators, who must balance a complex ecology that extends beyond a weekly tinkering workshop.

Co-Constructing Third Spaces

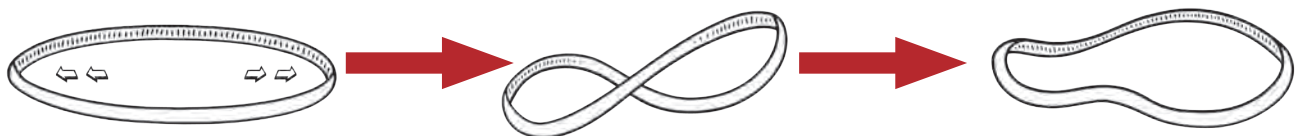
As we co-designed for belonging with afterschool staff and the participants in the tinkering program, questions of equity, culture, and power informed our pedagogical approaches. A central question was how to co-design a space with children who had heterogeneous

interests and histories of making. Drawing on notions of designing for the pluriverse (Escobar, 2018), we provided multiple pathways through which participants could engage. We did so by valuing their agency, whether they were repurposing tools and materials, transforming social norms, or influencing program design. This elasticity of design led to the development of pedagogical practices that educators in maker spaces and other afterschool programs can adapt to their own contexts.

In light of the fact that youth from nondominant communities have been marginalized in STEM contexts (Bang, Warren, Rosebery, & Medin, 2012; Martin, 2009; Nasir, 2011; Vakil, 2018), educators play a central role in redistributing learning opportunities in equitable ways. As making and tinkering programs become more prevalent, the field is challenged to reimagine the roles adults play in workshops where youth-led engagement is valued. In our design, educators in the tinkering program engage in joint activity with participants, taking such diverse roles as artistic mentor, skills instructor, social actor, and architect of an environment that supports inquiry and discovery. The pedagogical interventions described in this article expand concepts of how educators and participants co-construct third spaces for learning and becoming.

Designing for belonging is a co-constructed process that can take place in collaboration not only between young people and educators but also between partner institutions. This ongoing and iterative process requires educators to design from the ground up as they learn through conflicts that arise at the micro level on a given day in a given afterschool program. We've seen that, when this perspective is communicated to higher organizational levels, improved institutional support facilitates the design of out-of-school contexts that are sustainable for future generations.

Figure 4. The band on the left shows the learning space in tension, when Lewis cannot engage with the group. The second physical space made available by the director is represented by the folded rubber band in the middle. When Lewis is reintegrated into the program space, the rubber band unfolds to return to a relaxed, inclusive state.



Acknowledgment

The authors thank the Department of Children, Youth and Their Families of San Francisco for its ongoing funding of the program described in this article.

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