

One World: Refugee youth incubating epistemologies toward rightful presence with/in community-driven STEM

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Abstract:

This study investigates how recently resettled refugee youth took up STEM-rich making experiences at an after-school community club in relation to negotiating their resettlement process. Using critical participatory ethnography grounded in sustained engagement with and in community, authors 1 and 2 worked with refugee youth through sustained STEM-rich making programming where youth innovated and created products that they needed but did not have access to, at their residential community center. We draw on atmospheric walls (alienating messaging built into spaces) and rightful presence toward justice in teaching and learning, as complimentary conceptual frameworks to guide this study. Findings illustrate how youth engaged in allied political struggles to identify atmospheric walls at work in the community and how they seeded moments of rightful presence through leveraging both human and material resources in their STEM-rich making club. We discuss incubating epistemologies as a making present practice, especially in how particular power structures in refugee communities were made visible and specific stakeholders and their actions, identifiable. How youth engaged in allied political struggles through community-driven STEM, nested within the social dynamics of their resettlement process, is unpacked. This study provides insights into the possibilities for community-driven science. When STEM-rich maker education is driven by communities' needs and grounded in their epistemologies, it can attend to both epistemic rigor while also addressing injustice. We discuss the implications that a stance on community-driven science raises for the role of science education, especially when we concern ourselves with the whole lives of refugee youth.

Keywords: epilogies | justice | making | refugee youth | rightful presence | STEM

Article:

1. Introduction

“The Center is very important to us...but it is ugly. The walls are ugly, you have only vocabulary posters and flyers...doctor information...what the landlord say you can do and cannot do...It makes you feel very stress [ed] when you walk in the center after school and all you see are these things on the wall...The center should be pretty, we want to not be stressed, we want to feel relaxed when we come back to the center because school is already very, very stressful.”

– Sloan, 14-year old recently resettled refugee youth

In the above quote, 14-year-old Sloan, a Karen1 recently resettled refugee youth who had lived at the residential complex that housed the community center in question for 4 years, was reflecting on the sources of stress she and her peers who live at the complex, encounter across the spaces in which they spend their day. The community center, under the oversight of AmeriCorps fellows from a local university, offers a suite of services for the recently resettled refugee families that live there. These services include basic English language lessons for adults, workshops such as knitting and homework tutoring for school-aged children who usually spend after-school hours at the center until it closes at 5:30 pm. The center, as it is referred to by the youth, is also the place where health-care volunteers from the community provide services for the refugee community.

The center is thus essential in providing supportive services to the refugee community. However, it is also a contested space. In the 6 years that we have spent as STEM teacher volunteers there, we have observed both heart-warming and troubling trends. In the former, some youth received rigorous, one-on-one tutoring from college students genuinely concerned about youths' well-being, and friendships flourished; in the latter, tensions between youth from different nationalities and ethnicities simmered, fueling territorial fights for the “good tables and chairs” (non-wobbly donated furniture) and verbal altercations that led some to quit the center entirely, especially the older youth beyond elementary school. In addition, youth have communicated to us about how the physical space of the center itself felt “stressful”, as described in Sloan's quote.

As a once leading resettlement country for refugees globally, the United States admitted 1,118,628 refugees during the first two decades of the 21st century (2000–2019). This number is in sharp decline—2018/2019 reports indicated only 22,496 and 30,000 refugee admissions, respectively (US Department of State Refugee Processing Center, 2020). The relocation process is daunting, as refugees fleeing persecution often experience violence and trauma (McPherson, 2010). For many, the ensuing process of resettlement—operationalized as “the activities and processes of becoming established after arrival in the country of settlement” (Valtonen, 2004, 70)—is no less distressing.

Refugee youth invariably suffer sustained disruption of formal schooling at various points during their flight from persecution in hostile home countries to neighboring border refugee camps, to asylum-granting host countries (Dryden-Peterson, 2015). While schools are supposed to provide security and aid refugee youths' return to a sense of normalcy, they are rarely prepared to meet the particular needs of their refugee students (Hos, 2016). There is a lack of understanding about the processes of resettlement that might support or oppress refugees—how, where, for whom, in what ways, and to what ends. Prevailing discourses around refugee youth education tend to overwhelmingly paint them as victims of tragedy in need of language remediation such as intense English language learning (Fredricks & Warriner, 2016), with an over-emphasis on emotional and

psychological support (Matthews, 2008) but little to no emphasis on strategies to boost refugee youths' development in academic school subjects (McBrien, 2005).

How might STEM-rich making programs, such as the one we provide, when centered around community-driven science, support refugee youths' resettlement process? In this study, we seek to understand how recently resettled teenage refugee girls leveraged their participation in a weekly, STEM-rich, informal making program as integral to how they are negotiating their resettlement process in the community where they live. This community consists of a diverse range of refugee families from different parts of the world, all living within the same housing complex. We seek to understand how refugee youth make sense of the concept of “community” in such a setting, and how refugee youths' enactments of community drive STEM-rich making at, with and in this community.

The following research questions guide this study:

1. How do recently resettled refugee girls take up STEM-rich making at their residential community center in ways that matter to them?
 - a. What, if any, were the community issues identified as salient for youth? How did the youth operationalize community via these issues?
 - b. What, if any, were the relevant STEM-specific disciplinary content and practices that youth leveraged to address community issues?
2. What is the nature of the sociopolitical relationality undergirding the refugee girls' STEM-rich making experiences and their resettlement process at their community?
 - a. In what ways did the youth leverage STEM-rich making activities to address personal and community concerns?
 - b. How were they supported (or not) in doing so?

1.1 The sociopolitical terrain related to refugee youth education

It is an understatement to say that significant educational challenges have historically and continually plagued refugee youth throughout their young lives. Surveying the educational trajectory of refugee youth across the three time periods of “pre-settlement, arrival and post-settlement” (Dryden-Peterson, 2016a, p. 133), challenges abound within and across these time periods. In the pre-settlement period that takes place in the first country of asylum (as opposed to a final resettled country where refugee youth and their families are granted access to naturalized citizenships), refugee youth universally have unequal and sporadic access to public education. For instance, 47% of refugees have access to primary education in Malaysia, compared to 97% of citizens while in Lebanon, 19% of refugee youth are enrolled in secondary schools versus 68% of citizen youth (UNHCR, 2012). Further, conflicts between citizens and surveilling authorities of first asylum nations and refugees lead to a high degree of reluctance for refugee parents to allow youth to go to schools (Dryden-Peterson, 2016a).

Across the three time periods while in public schools, refugee youth struggle with and are marginalized for their limited English proficiency (DeCapua & Marshall, 2015; Duran, 2017), enduring tensions and microaggressions related to social integration (Roy & Rozas, 2011). Refugee youth also face challenges in their home lives related to poverty and alienation, while negotiating the complicated processes of resettlement (Bajaj et al., 2017; Sullivan & Simonson, 2016). It is thus apparent that refugee youths' global educational trajectories are trailed by arcs of conflict. This stark disjuncture between the desired outcomes of “access to quality education for refugees” (UNHCR, 2012, 8) and the realities mired in injustice led both refugee community members and UNHCR staff members to lament that refugee education could be characterized as an “education for ultimate disappointment” (Dryden-Peterson, 2016b, p. 478).

A major contributing factor for such “ultimate disappointment” is the fact that refugee education is entangled in “multiple registers” of rights (Somers & Roberts, 2008, 388) where international authorities such as the UNHCR, host nation-states, local municipal bodies and different education systems conceptualize, codify, and regulate refugee education in vastly different ways (Dryden-Peterson, 2016b). Decisions made by authorities at these different levels are inadvertently filtered through prevailing social narratives surrounding refugees, emphasizing the reality that refugee rights are “socially constructed and historically contingent” (Mundy, 2007, p. 340). In the United States, the aggressive, militant stance of the 45th administration toward refugees has resulted in the abrupt and extreme curtailing of refugee rights previously ratified in the United States as a host nation (Pierce et al., 2018).

Challenges abound when we hone in to the experiences of refugee youth who do have access to public schooling. Pre-settlement trauma leaves refugee youth with sporadic educational opportunities at best, leading to difficult transitions and integrations into host nation educational systems. Across discipline-areas but mostly in literacy, researchers point to challenges related to poor language proficiency, including refugee youths' native languages (DeCapua & Marshall, 2015). Cultural incongruence and identity dissonances lead to struggles in school, resulting in microaggression and discrimination (Roy & Rozas, 2011). For example, Somali refugee youth reported being accused of “acting White” by their US classmates for doing well in classes (Birman et al., 2001). These challenges are formidable and act to push refugee youth out of school (Suarez-Orozco et al., 2010). Such experiences reflect how refugee youth are “caught between the global promise of universal human rights, the definition of citizenship rights between nation-states and the realization of these sets of rights in everyday practices” (Dryden-Peterson, 2016b, p. 473).

1.1.1 Challenges inherent in refugee youth education

There is a consistent call for educators working with refugee youth to become more aware of the range of trauma and difficulties they have experienced and to actively provide socio-emotional support to address the long-term lingering impact such trauma continue to have on youth (Sullivan & Simonson, 2016). At the same time, educators are equally exhorted to appreciate the resilience and wealth of everyday experiences refugee youth bring to learning (Gagné et al., 2017). For example, Hos (2016) juxtaposed the formidable responsibilities typically reserved for adults in a household that is the quotidian lot for Southeast Asian refugee youth—working part-time jobs to supplement family income, cooking daily meals, and significant sibling-raising duties—all while attending school, without emotional or psychological support even as they were attending a Newcomer school tailored for refugee and immigrant youth. Similarly, Arvanitis et al. (2019) documented the perilous experiences Syrian refugee youth endured, acting as “powerful social

agents able to transform their current and future lives and societies in which they will be integrated” (p. 142) while simultaneously locked in moratorium due to the lack of supportive educational services while they await in transit at a holding refugee camp in Greece.

Some studies juxtaposed strength-based approaches with the exposure of institutional power-dynamics that work to persistently sideline refugee youth. Roy and Roxas (2011) document how teachers and staff at a school conflate what they perceived as disruptive behavior of Bantu refugee students—ranging from girls wearing headscarves and long skirts to students' supposed lack of interest in learning—as rooted in Bantu culture. Counter-stories from Bantu students and parents instead reveal their desire to learn and achieve academically, despite struggling with hostile instructional approaches. Bantu families also exerted efforts negotiating between being respectful of school norms while honoring religious beliefs in their dressing. Duran (2017) in her work with Karenni youth highlights their transnational multilingual expertise and hunting abilities, highly admirable qualities which were devalued and shunned by the mono-lingual, dominant western culture school system.

Other education researchers working with refugee youth have leveraged inclusive pedagogical approaches grounded in anti-deficit perspectives. For example, Gilhooly et al. (2017) worked with three Karen brothers in an out-of-school participatory action research project to seek out other members of the Karen diaspora to engage in critical dialogue, documenting the community's experiences in their resettlement process. Ryu and Tuvilla (2018) utilized counternarratives to showcase the complexity in Chin refugee youths' narratives of themselves as hardworking, tough, and joyful while bullied, misunderstood, and despised by citizen youth and teachers in school. The authors urge for supportive school environments that allow for code-switching of multiple languages and for school authorities to be aware of inequities suffered by refugee youth.

Specific to STEM education with refugee youth which we contend is under-researched, scholars have stressed the value of connecting learning experiences to students' ethnic and cultural identities. Engaging in culturally responsive pedagogy (Ladson-Billings, 2014) is one productive way forward. For example, Upadhyay (2009) documented the impact a science teacher, a Hmong refugee, had when she drew on shared cultural understandings with Hmong refugee students, in co-constructing science learning experiences that were culturally responsive. Similarly, Hammond (2001) highlighted the import of active community involvement in refugee youths' learning experiences with a community-school partnership to build a Mien-American house in a school serving Mien refugee children. More recently, an after-school STEM program supported Burmese youths' drawing from their funds of knowledge (such as cultural beauty regimes) and youth culture (humor, turn-taking) to engage in otherwise intimidating science discourses (Ryu et al., 2019). Albrecht and Upadhyay (2018) reported that for recently resettled Somali mothers, their ideas of a robust science education is one that focuses on science and everyday practical applications, such as “making good decisions about food choices, understand health effects of fasting [during Ramadan]” (p. 615).

Yet, even when considering pedagogical and research approaches that prioritize anti-deficit perspectives and that center refugee youth agency, tensions remain. Undoubtedly, the moral imperative to value the unique potential of every refugee youth is sacrosanct. At the same time, there remains the fact of the large gaps in their knowledge base valued by the American education system that gatekeep their advancement through said system, the route toward the better life that the youth and their families have sacrificed enormously for (e.g., Hos, 2016). What are the considerations, and inherent tensions that allies of refugee youth, including educators and

researchers need grapple with? How do we simultaneously honor refugee youths' everyday experiences as resources in teaching and learning, while equipping them with the knowledge and skills to advance through the gatekeeping measures in American schooling? In short, how do we educate minoritized, refugee youth about what Delpit (1988) called “the codes needed to participate fully in the mainstream of American life” while making sure they also understand the “arbitrariness of the codes” (p. 296) and the unequal power dynamics in which they are entrenched?

Embedded in this tension is an acute conundrum particular to refugee youth whose quest for security is somewhat predicated on replacing current identifiers with those of the powerful Other. Their lived experience in forced migration is characterized by the continuous disruption of routines, leading to a sense of ambiguity and loss of status tied to a seemingly perpetual, exilic state (Downing, 1996) so that a re-establishment of routines is a mechanism that refugee youth seek, to regain a sense of agency (MacDonald, 2015). How then, should adult allies working with refugee youth presume to sympathize with the kind and degree of such trade-offs, and the implications for designing supportive learning experiences?

To further complicate matters, refugee youth invariably find themselves in learning spaces characterized by hyper-diversity (Malsbary, 2016), described as “more languages, more cultural affiliations and [the] blurring [of] national, ethnic and racial categories in schools” (p. 1492). In a hyper-diverse community, how does an educator begin to take a culturally relevant approach? Malsbary reported that one school's response was to value some youths' cultures and linguistic assets over others, in a context where “power shape shifts” (p. 1514) across spaces in the school and through school activities. In our study, we seek to “grapple with the cultural politics of space” (p. 1514), which we find important when inclusive pedagogies are juxtaposed against spatial realities characterized by hyper-diversity.

1.1.2 Community-driven science in the context of hyper-diversity and disrupted historicity

Community-driven science has been operationalized as science that centers the “wellbeing of communities and their members” (Ballard et al., 2021), where community concerns grounded in lived experiences are the reasons for engaging in science (Calabrese Barton & Tan, 2010; Morales-Doyle, 2017) and where community wisdom and science are integrally imbricated (Birmingham et al., 2017; King, 2017; Van Wart et al., 2020). A central goal of community-driven science is to intentionally focus on people and cultures historically minoritized and sidelined in the Western scientific enterprise. As such, community-driven science is well-aligned with the educational profile of recently resettled refugee youth.

A shared sense of history and experiences undergird the contexts of compelling community-driven science with historically minoritized youth. Calabrese Barton & colleagues (2017) described how youth who had spent time as members of a community club since elementary school, who essentially grew up together, were positioned as community-insiders with shared experiences because of shared identifiers (Black boys) to center their STEM-rich making experiences on real-life concerns: police brutality and the Black Lives Matter movement. This group of close-knit boys designed and created what they named a “phantom jacket” that has a hidden, wind-powered alarm that could be used to call for help should they encounter police brutality. In another study, King and Pringle (2018) showed how Black girls who participated in a summer informal STEM program where their counternarratives in STEM were actively solicited as core STEM activities supported the girls' mutual support for one another where their identities

as Black girls with shared community were celebrated as integral to STEM engagement. The girls collectively and critically unpacked the role of race in their STEM experiences in across formal and informal settings in productive ways. Across these studies, the shared historicity and cultural ways of being were contingent to the solidarity in which Black youth collectively held for one another.

Indigenous scholars have called for the necessity of culturally responsive science teaching and learning, including in informal science programs, for indigenous youth. Indigenous ways of being and practices rooted in reciprocity and relationality with land, floral, and fauna need to be central to indigenous youths' science education (Archibald, 2008; Bang & Medin, 2010; Cajete, 2000). Barajas-López and Bang (2018) detail the expansive outcomes for indigenous youth and adult participants in an informal making program that reflected the richness of indigenous culture, wisdom, and expertise. Designed and facilitated by indigenous artists and elders for indigenous youth, the making camp featured pedagogies of “walking, observing and talking lands and waters” (p. 7) inherent in indigenous culture.

These studies emphasize the importance of departing from Western science and centering people of color and their cultures as anchors of informal, community-based science teaching and learning. These studies also highlight the contingency of shared histories within groups in which such culturally responsive designs are rooted. Such a shared history is missing in the context of recently resettled refugee youth residing and negotiating hyper-diverse spaces. For recently resettled refugee youth in such contexts, what and who constitutes community and shared history, where and when? In a context of hyper-diversity, what would a justice-oriented, culturally responsive community-based science program entail? Without a shared history, this is not an easily answered question. We turn to Anzaldúa's (2007) theories on borderlands for guidance and insights.

Gloria Anzaldúa's writings on borders and borderlands, physical and metaphorical, (Anzaldúa, 2007) highlight the division between people wrought through unequal power and overt oppression, where particular bodies (e.g., refugees) are systematically and intentionally excluded. She argued that inhabiting the borderlands necessitated disparate elements, cultures, and social systems to mix and combine in unexpected ways, yielding new perspectives and possibilities to their inhabitants toward “a new consciousness” (p. 99). Anzaldúa further asserted that such a new consciousness is contingent on “a tolerance for ambiguity” (p. 101), as “the future depends on the breaking down of paradigms, it depends on the straddling of two or more cultures” (p. 102). Working toward a “new consciousness” is inherently tension-filled and complex. In the context of recently resettled refugee youth inhabiting a hyper-diverse community akin to borderlands, working toward a new consciousness arguably necessitates identifying and naming particular oppressions at work while simultaneously embracing vulnerabilities in seeking new possibilities for a more just future and in the here-and-now. This work needs to be taken up by youth, researchers, and adult members of the community. For educators and researchers concerned about community-driven science, we need to consider what such a “new consciousness” might entail in a community where arguably what is “shared” among the recently resettled refugee youth are only, (1) their identities as recently resettled refugees in this particular state, and; (2) the geographical space from being housed at the same residential complex. Beyond these, ambiguity characterizes the relationships different refugee youth and their families have with one another in this community.

1.2 Conceptual framework: Atmospheric walls and rightful presence for justice-oriented teaching and learning

An under-theorized aspect of the educational experiences for refugee youth lies in their forced, perpetual liminality. Unlike minoritized citizen youth—who no doubt struggle against intersecting systemic oppressions related to their education—refugee youth are less able to lay claims to domicile and place-based cultural histories and traditions because their historical plight has been one of peripatetic flight. To seek a nuanced understanding on how the cultural politics of space intersect with socially negotiated processes of educational activities with refugee youth, we draw on two conceptual ideas: atmospheric walls and rightful presence for justice-oriented teaching and learning.

1.2.1 Atmospheric walls

One manifestation of unequal power dynamics in a learning setting often leads to the positioning of some learners as central and others as marginal. Establishing such a pecking order need not be the product of overt political acts—subjects can also be contoured into place through the effect of “atmospheric walls” (Ahmed, 2014a). As Ahmed described, “an atmosphere can become a technique, a way for making spaces available for some more than others” (Ahmed, 2014b). An immaterial wall through signaling particular atmospheres to particular bodies, exert very material effects. Often erected through discourses and social interactions, atmospheric walls can cause particular persons (usually the ones with less power) to become uncomfortable in a space, prohibit one's participation through increasing self-censorship, and intensify feelings of alienation, of how one matters less. Encountering and negotiating atmospheric walls, therefore, often precede social and political struggles. Ahmed describes with somber clarity the invisible way in which boundaries are erected and maintained through atmospheric walls. As she writes, “Atmospheres: how you can be made to leave as if ‘out of your own will.’” (Ahmed, 2014a).

Ahmed further points out the insidiousness of atmospheric walls—that “they only appear to some and not others” (Ahmed, 2014a), and that one “feels surrounded by what you are not” (Ahmed, 2014b, emphasis authors'). For example, her research with staff and faculty members serving on diversity taskforces in universities revealed the stark disparity between what taskforce members-of-Color perceive with regard to issues and challenges, compared to White colleagues (Ahmed, 2012). For white colleagues, a diversity taskforce need not upset the status-quo; for colleagues-of-color, disruption of existing inequities is the taskforce's *raison d'être*. For White taskforce members, engaging in “diversity work” is a way to further burnish personal and institutional professional reputations; for colleagues-of-Color, to engage in a diversity taskforce is to take on significant professional and personal risks in the hopes of working toward a less oppressive, imaginary future in the institution, with no guarantees of such happening. In this context that Ahmed (2012) detailed, an institutional, atmospheric wall is the mechanism that acted during taskforce meetings to silence and constrain colleagues-of-color in a diversity taskforce, a stifling that is invisible to White colleagues. Although immaterial in form, atmospheric walls are erected through the maintenance and reproduction of established norms and practices that align with the axiological bases of the more powered, that act to continually deny the less powered a rightful presence.

1.2.2 Rightful presence for justice-oriented teaching and learning

Rightful presence is a framework that emerged from critical justice studies around borderland and refugee communities in welcoming host countries. It urges a more critical framing that problematizes the lens of “hospitality” (Barnett, 2005) where a seemingly benign guest|refugees/host|welcoming country relationship is assumed. Rightful presence urges disruption and the reconfiguration of what counts as legitimate in a place, informed by social and political struggles (i.e., who has a right to participate within community, what are legitimate practices) (Squire & Darling, 2013).

Explicitly critiquing the ideal of equity as inclusion, the rightful presence framework has been adapted specifically for investigating justice-oriented teaching and learning, anchored in three tenets: (1) The right to reauthor rights through political struggles with the support of allies; (2) Claiming rightfulness through making (in)justices visible; and (3) the necessity to collectively disrupt guest/host relationalities in teaching and learning settings through amplifying the sociopolitical (Calabrese Barton & Tan, 2020). Taken together, indicators of minoritized students' rightful presence in teaching and learning include consequential (as opposed to symbolic or perfunctory) say by students in the processes of learning and outcomes that materially “claim space” and that concretize presence, meaning, students need to be doing, taking actions that matter to them while they are corporeally present in the teaching and learning physical space.

Beyond equity as inclusion, authoring a rightful presence in teaching and learning necessitates disrupting established norms and critiquing, through engaging in sociopolitical struggles, what has been previously framed unproblematically as welcoming or inclusive.

For example, in a sixth-grade classroom where students engaged in an engineering for sustainable communities unit, researchers found that when learning experiences explicitly centered the school community as insiders and experts to inform a community problem-space, students were supported to make visible injustices they experienced daily as middle schoolers (Calabrese Barton & Tan, 2019). With teacher support, students engaged in “making present practices [that] reflect[ed] the ongoing struggles students face[d] in their lives as well as their efforts to project their lives onto learning and doing STEM in consequential ways” (Calabrese Barton & Tan, 2019, p. 35). Engaging in iterative engineering design with community feedback students created working prototypes such as a bathroom occupancy lighting system called the “Occupied” for their lock-free class bathroom, to address the injustice of targeted bathroom bullying and a light-up positive messaging box called the “Happy Box” where students and teachers leave encouraging notes for one another daily to counter low school morale. Across a range of prototypes engineered for community welfare, moments of rightful presence emerged when injustices were made visible (e.g., targeted bathroom bullying) and addressed through sustainable engineering design, made possible by allied political struggles (teacher and students working together, engaging in classroom discourses that centered community narratives that were never part of regular science classroom practice). Moments of rightful presence for students were contingent on shifting power dynamics between teacher and students, and between students. Across these dynamics, more power shifted toward students who had held less power (the English language learners, students of color, and LGBTQIA2S+ students).

Taken together, collectively working toward rightful presence with refugee youth in an after-school STEM-rich making club involves youth and adult club facilitators engaging in allied political struggles. Such allied political struggles involve making visible and naming injustices that may be operating through atmospheric walls and using STEM-rich making as a tool to work

toward breaking down these walls toward justice as refugee youth simultaneously author a more rightful presence in their community and in STEM.

2 RESEARCHER POSITIONALITY AND ETHICAL CONSIDERATIONS

As educational researchers concerned about issues of justice and mindful of the ways unequal power dynamics operate across educational research activities with minoritized youth, we have worked to build relationships with the community. Prior to engaging youth in weekly STEM programming, we spent a year tutoring weekly. To date, we have been working with youth for 6 years, collaborating on weekly STEM programming during the academic year and one-week intensive summer camps.

Edna is a Southeast Asian immigrant who regularly experiences real and symbolic violence in the academy. Perpetually positioned as an outsider through “backhanded compliments” (e.g., “I’m amazed you can correct my grammar!”) and verbal violence as she navigates the geographical terrain of her context (“Chink Chong!”), her encounters with atmospheric walls and the denial of a rightful presence is deeply embodied. Bev is a white, western, middle-class woman. While this positioning bestows privilege, a childhood shaped by intense poverty and long-term emotional abuse carved an indelible awareness of, and determination concerning, issues such as marginalization and othering. Our experiences together afford us different angles to consider how centrality and marginality, in kind and degree, can be imposed, negotiated, and experienced through social and institutional practices.

At the same time, while we are community-engaged researchers committed to justice, we are acutely aware of the power we hold as university researchers. Acknowledging the reality of this power differential between us, as university partners and the community members that include the youth, is important in two ways. First, we are mindful that regardless of our best intentions, we will reproduce unjust power differentials in our interactions with refugee youth in community. We are cognizant of our own complicity as university researchers in contributing to this challenge that is inherent in allied political struggles. Injustices are difficult to identify, not least because powered stakeholders (such as ourselves as university researchers) are entrenched and benefit from, these historical, unjust power structures. What we do pay attention to constantly, as a result of this awareness, is to figure out with youth, how to concretely act as political allies to counteract the unjust “norms” we automatically enact. Such allyship is contingent on building trusting relationships.

Second, awareness that as university partners, we hold power and can and should be leveraged in constructive ways in community-engaged research partnerships have also opened doors for us to broker for particular kinds of activities with other adult administrators, who run the day-to-day logistics of operating the refugee community center (in which the STEM program is housed). We do not shy away from seeking out and knocking on these doors.

3 METHODOLOGY: PARTICIPATORY CRITICAL ETHNOGRAPHY

Our study centers the experiences of resettled refugee youth as they negotiate the why, what, how, for whom, and to what ends, of engaging in STEM-rich activities in their residential community center. We engaged in participatory critical ethnography (Bang & Vossoughi, 2016). Participatory methodologies unsettle power-dynamics between researchers and participants (Cammarota & Fine, 2010), while critical ethnography privileges multiple perspectives and allows for critical

critique of oppressive relationships (Weis & Fine, 2012). An ethnographic approach where we embed ourselves in context is necessary for this study, given ethnography's focus on investing cultures, documenting activities *in vivo*, through direct contact via physical and social interactions (LeCompte & Schensul, 1999). Ethnography thus is a methodology that affords an outsider researcher to gain an insiders' perspective in context, with an understanding of the rules and norms that govern particular practices in the “natural context”. In order for us to gain a nuanced understanding on the nature of “community” at Willow, an ethnographic approach made sense. However, an ethnographic approach is by nature agnostic—it merely describes specific cultures (Madison, 2011) without focusing on power dynamics or the sociopolitical forces therein. Since we are explicitly concerned with the sociopolitical, we layered on a critical and participatory approach that center the political and explore emancipatory implications relevant to the study.

Prior to the data reported in this study, we had spent time informally at Willow community for a year, participating as volunteer tutors to the youth weekly and sharing time with the adult refugee residents during community-days organized by the Americorp fellows who run the center, such as movie nights, end of semester food celebrations and pizza hangouts. These informal times being together at Willow were not only important and foundational to relationship building, methodologically-speaking, embedding ourselves thus in community was the only way to observe the norms and practices of this community space, and how they operate.

Data specific to this study was collected across 1.5 years, working weekly with youth in STEM club. Data sources include: (1) weekly fieldnotes, (2) Informal conversation groups, (3) STEM club artifact interviews with refugee youth, and (4) youths' making artifacts. Across the two projects that inform this inquiry, youth invested approximately 76 h working in the Club. Many of the youth who participated in the projects reported were also ones we had tutored and spent time with, in weekly STEM-rich making club prior to these particular making club projects.

Data were analyzed in the grounded theory tradition, using a constant comparative approach (Straus & Corbin, 1998). The first phase of analysis involved open coding to surface, (a) critical episodes that featured particularly salient performances, in talk and actions, by refugee youth that related to their resettlement processes, specifically as experienced at the community club complex; and (b) the knowledge and practices that youth drew upon during critical episodes that may be community-based or STEM-rich club making based, including human and material. We identify critical episodes as those where youth engage in ways that go beyond what we had witnessed in our regular programming when youth might ask questions limited to the specifics of the making activities, for example, “how do I save this picture” while we were creating stop-motion animation. By critical episodes, we mean when data reflected youth performing in more animated ways in their speech and interactions with us, when there were evidence of responses from youth that were joyful, serious or perturbing, that alluded to their everyday lives, their concerns and desires as related to their resettlement processes, beyond the constraints of the STEM-making activities. We then engaged in axial coding to make sense of the relationality between STEM-rich making engagement and resettlement process negotiations, analyzing the who, what, why, when, to what ends, that refugee youth take up STEM-rich making as related to the nature of identified atmospheric walls.

Across each phase, we paid attention to how youth were framing what community might mean at Willow through the descriptions they used to talk about the community spaces, people, events, and activities that occur at Willow. Dialogically, we considered how available materials and tools, relationships, physical spaces, institutional practices, and opportunities for agency are connected to how youth narrated and enacted their positionality within the Willow community. We

explored the possibilities and the ways in which the community STEM-rich making program might afford what kinds of opportunities, mediated through what kinds of interactions, to support youths' naming of atmospheric walls. In short, we looked for how the youth were holding community and community-driven science, in dialectical relationship through the nature of their participation in the community STEM-rich making program. Finally, we considered the nature of allied political struggles youth engaged in, in their bids for rightful presence. This involved identifying what kinds of unjust, atmospheric walls were made visible and what kinds of allied political actions refugee youth took with us, stem-club facilitators, to perturb these walls, to what resettlement-process community-relevant and STEM disciplinary learning-related ends.

3.1 Context

Willow center is a community center in a low-income housing complex where recently resettled refugees from multiple nations across Africa and South Asia make up more than 70% of the residents. Staffed by AmeriCorps fellows² and university student volunteers, Willow center provides after-school tutoring for refugee youth from Mondays through Thursday afternoons, and enrichment activities, including the STEM club that we facilitate weekly (120 min), on “Fun Fridays,” throughout the school year. The center is also used by community volunteers working with parents and adults, where services such as learning English, sewing skills, and health service workshops are periodically provided. Given the wide range of nationalities, multiple languages are spoken at Willow center, amidst inadequate interpreter services. Youth in the STEM program all spent significant time on border-nation refugee camps before being granted asylum in the United States and experienced interrupted schooling. For the data reported in this study, all youth participants were girls aged between 10 and 16 years.

3.2 STEM-rich making at the center

The maker movement has evoked interest for its potential role in breaking down barriers to STEM learning and achievement (Martin, 2015). Described as a fusion of shop class and digital fabrication, makerspaces offer opportunities for youth to engage in STEM knowledge and practices in creative and playful ways, where “learning is and for the making” (Sheridan et al., 2014, p. 528). However, the fast solidifying maker culture has been critiqued as reproducing the historical culture of STEM—white, male, and middle-class—with little attention paid to how the maker culture should be perturbed toward justice (Colleagues + Author). We focus on STEM-rich making because STEM is a domain for whom refugee youth have been denied equitable access.

In addition, community-focused STEM-rich making has been shown to be productive in supporting minoritized youths' development of STEM competencies in equitable and consequential ways—equitable in terms of sustained, well-resourced opportunities to make and consequential in how the process and made artifacts were meaningful personally to the youth and addressed concerns in the community (Tan & Calabrese Barton, 2018a, 2018b). In our work, we focused on STEM-rich making activities that would serve a co-identified community need, keeping in mind that the idea of “community” for refugee youth at Willow would be complicated and fraught. Questions we kept as a guide for ourselves in our facilitation of the club include: What constitutes community in a refugee residential area? Does being physically placed in close proximity to one another because of how one is labeled by the host country automatically make us

a community? What do we assume communities share and how might that be manifested (or not), at Willow?

In our dual role as researchers and facilitators of the STEM-rich making club committed to positioning the refugee youth as equal partners, we deliberately structure the what, how, when, why of making projects around issues that the youth might care about in their day-to-day living. We invited youth to consider how they might use their participation in making to address problems that concerned them in the Willow community. At the point of the two projects that informed this study, we had maintained a constant, weekly presence at the center, running the program for three consecutive years.

Prior to working exclusively with middle and high schoolers in the projects reported in this study, we had worked across age groups with any child interested in participating in “Fun Friday STEM club.” The mixed age-group context facilitated familial, care-giving responsibilities for many of the upper elementary and middle school-aged youth who participated, some with 3- to 4-year-old siblings in tow. Such an arrangement necessitated our planning activities that were accessible to a wide range of age groups.

That academic year, we focused the making on activities that were food-related because youth expressed hunger frequently when they arrived at the center after coming home from school. We intentionally designed STEM-rigorous making activities that used edible items, such as designing bridges with different-sized marshmallows and different length and thickness toothpicks and investigating the different thickness and creaminess of ice cream that could be made from various kinds of milk, investigating the mathematical concept of Pi with making different kinds of pie, on Pi Day. After each STEM-rich making session, youth would bring whatever they have created home to either play with, or to share the food ingredients with members of their family. We intentionally brought extra materials as a matter of course. It was clear that at Willow, while there were different kinds of donations brought in by volunteers, snack items were not in adequate supply.

4 FINDINGS

In what follows, we describe two projects that informed this study, then look across the projects to unpack two claims: First, the youth at Willow used the context of STEM-rich making to figure out the sociopolitical characteristics of their community, including identifying and critiquing the atmospheric walls present at Willow community, and how they worked to structure their participation in STEM and at Willow. Second, as youth figured out these sociopolitical characteristics, they leveraged these insights as integral to STEM-rich making itself. Not only were their STEM-rich artifacts infused with their community insights and designed toward addressing community issues at Willow, they also seeded moments of youths' rightful presence in both the Willow community and in the STEM-rich making program, challenging the dominant powered boundaries between the STEM program and the community. In other words, the youth acted to center Willow in the STEM program beyond a mere site where the program was held.

Both of these projects involved only girls. We were asked by the Americorp fellow leading the center to teach a STEM program only for girls as the attendance of girls at the center had been lagging and the Americorp fellow imagined a program just for girls might compel more dedicated attendance. As a result of Project one that was embarked on in the summer as a response to the all-girl programming request, the group of girls asked that we continue an all-girl STEM program into the school year, which we did. Project two took place as a year-long, weekly program.

4.1 Project one: Creating soft-toys and light-up weekend handbags with e-textiles

The summer programming schedule at the center presented an opportunity to work exclusively with girls from ages 10 to 16. In a 2-week, intensive making camp (total of 40 h), 11 girls engaged in e-textile making and created light-up soft toys and light-up purses (Figures 1-4). The focus was identified with youth in a co-planning meeting that lasted 2 h. During the conversation, we reflected on the toy-making activities that were the focus of the making club in the Spring semester that just passed. The girls commented accurately that all the toys made thus far were more suited to younger children (e.g., strawbees interactive toys built from plastic connectors and different colored straws, climbing creatures using yarn and cardboard doll card outs, small hovercrafts). They suggested that for the summer making session, they would like to make some stuffed animal toys that they design, for themselves (i.e., older children and teens). The conversation broadened beyond what the STEM-rich making club had done to touch on what necessary “things” were missing at Willow. The girls started naming items that lacking in the donation room (a room at the center where donated items, mostly clothing, school bags, and some children's books, were stored). Sana asked if we could make small bags, “not big like school bags, small bags.” Mani added “like you can use to go out, not to school.” When asked if they meant handbags that women carried, they replied, “yes but not old and not big.”



Figure 1. (a) How Anna wanted her initials on her purse; (b) where Jian wanted to place a zipper; and (c) Jian's sketch up of the circuit that would power LED lights as part of her design



Figure 2. (a) Anna modeling her light-up purse, (b) the collection of purses made by youth, and (c, d) close-up of two purses made by youth



Figure 3. (a) Anna's sketch up design of the monster toy; (b) monster toy she created, and (c) Anna and her baby sister, for whom she made the toy



Figure 4. (a, b) Soft-toys created by youth; (c) sketch up of owl toy; and (d) hybrid toy bag for young friend

The STEM-rich making-specific skills youth learned and developed included basic needle sewing with the running stitch and back stitch with regular floss and with conductible thread. The latter required more practice and patience as metal-infused thread is brittle. Youth also learned how to use sewing machines with basic stitches. For STEM-related knowledge and practices, youth learned about circuitry and electricity flow, including switches (what they are and how they function in a circuit) and how short-circuits occur when conductible thread overlap. These STEM epistemic insights were gleaned and solidified through hands-on making activities—prototype sketch-ups on paper and then troubleshooting during the making process.

4.2 Project two: “One World” large canvas electric art to beautify the center

Across 6 months of weekly, 90-min sessions, a core group of six girls, all of whom participated in Project one described above, worked to create a 24 × 48-in.2 piece of light-up electric art on stretched canvas that they named “One World.” The idea of a larger-sized art piece was exciting to the youth. They opined that if it were bigger than the educational posters adorning the walls of the center, “when people walk in, they will automatically look at it.” At the same time, the girls agonized over their self-described lack of artistic talent, with Zani emphatically exclaiming with seriousness, “we are not good drawers. We cannot draw.” This led to exploring art-based making resources, from tracing designs to creating designs with a spirograph tool.

Over time and with much deliberation, youth designed the layout of the art piece. This involved painting different shapes with various colors for the background of the canvas. It entailed looking across the range of spirographs they made and figuring out which ones to feature, in what kind of design. Making-specific skills included learning and becoming adept at using the spirograph to create as many as 70 individual designs before 45 that were deemed “good enough” for the art piece were chosen. When the girls decided they wanted particular spirograph circles to light up, we worked on engineering paper circuits that would go on the back of the canvas. This process took weeks of learning and testing. STEM-relevant content knowledge and practices youth encountered and gained expertise were again centered on circuitry but this time using both copper tape and thin wires to create a fairly complex network of parallel circuits for the 15 LED lights on

the design. Figuring out the circuitry led to the youth learning about and working with resistors (including pairing particular ones to particular LED colored lights that match the load requirement of different colored lights) and locating where in the circuitry it would make sense to include switches. Youth built simple switches using paper engineering (utilizing accordion folds) with metal brad fasteners and metal paper clips (see Figures 5-8).



Figure 5. (a, b) Youth exploring with the spirograph tool; and (c) Spirograph designs youth created

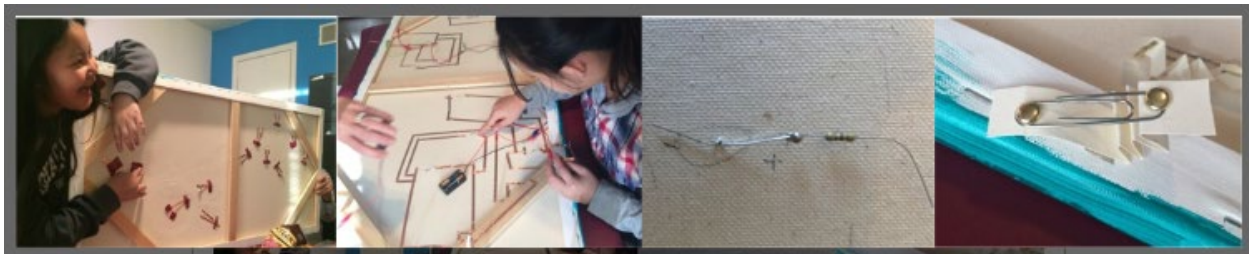


Figure 6. (a–c) Youth working with increasing facility in creating parallel circuits; (d) connecting resistors; and (e) a switch



Figure 7. "One World" electric art



Figure 8. (a) American currency poster; (b) place-value mathematics poster; and (c) center tutoring calendar

4.3 Finding #1: Identifying atmospheric walls at work at Willow community—Youth leveraged STEM-rich making at the center to identify and resist atmospheric walls

In the process of exploring engaging in community-based STEM-rich making is, youth collectively identified oppressive practices and atmospheric walls that negatively impacted them as a condition for deciding what it is they wanted to make, and why. In other words, identifying their needs at Willow community gave direction to their STEM-rich making projects, including what they wanted to make, why, and for whom in the community. One atmospheric wall at Willow that youth identified was that of refugee childhood & youth denial. While engaging in e-textile making, the complex, interconnected issues of babysitting responsibilities and lack of toys in the community emerged. While the summer making program was for middle and high school girls, a few could only attend if the younger relatives they were responsible for could tag along. Permission was sought and granted from both parents and adult facilitators (Authors). During the first 2 days, the girls spent time acquiring the foundational skills of e-textiles and circuits.

At the planning conversation on what the camp ought to focus on – “what should we make with e-textiles?”, the girls brought up what they were missing in their community and that they wanted to make at the camp—soft toys and small handbags. Anna, a 12-year-old (who had to bring along to the camp her 2-year-old toddler sister) explained, “We have no toys, nobody give toys... clothes and shoes, we get ...people donate... but no toys.” We have observed that while the center receives a consistent donation of clothing, shoes, and school backpacks, there were no toy donations at all. We were not surprised with Anna's sentiments as youth we had worked with before in this program articulated the same disappointment regarding the lack of toys due to a state rule prohibiting used-toy donations. The girls also noted that there were generally no accessories to be found in the donated items, including small handbags that they could carry on weekends. On the occasions where we have used the donation room at the center as additional space for youth to work in during our programming, we have noted an ample supply of donated clothing (youth and adults, both sexes) and school backpacks, some (mostly adult) shoes, and little else.

Facing a lack of longed-for, child and teenager specific items (soft toys and small handbags), youth utilized the opportunity of a STEM-based making camp to learn how to create these items. It was clear to us that the girls had distinct ideas of what they wanted from the moment they started to sketch up their designs on paper, down to the sizes and specific design-features. It was equally apparent to us that, with sufficient adult facilitation, they had the ability to grasp related STEM content on circuitry (including the relationships between electricity flow, load, resistance, and power) and engaged in rigorous sense-making that necessitated their pivoting from the technical elements (such as circuitry elements) to the social elements (Author + colleagues) of their design. None of the girls had specifically learned such science content in their school science classrooms. These were not trivial STEM expertise they developed.

For example, the specific location of LED lights on the surface of a small handbag would determine the layout of the sewn circuit on the inside of the bag; the location of the 15 LED lights on the One World art piece had implications on how the circuitry needed to be laid out on the back of the canvas. Engaging in these making processes required pain-staking effort, where progress was mostly slow and iterative, with troubleshooting, foundational. The youth all stuck with the process, tensions notwithstanding. They encouraged one another. Fieldnotes showed that conversations were filled with expressions of frustration (“This is so hard!”, “Edna, help me!”, “Did you do it? Show me?”) with joyful exchanges of how they are looking forward to using their handbags and how one another’s creations are “so cute” and “so pretty.”

However, none of the STEM would have been relevant if not for the youth-identified, community-driven, need—they desired toys and weekend handbags that were unavailable from the generous donations brought to Willow community, as a recognized recently resettled refugee housing site. Anna made her soft toy for her sister (Figure 3) and when a younger neighbor who needed community babysitting was dropped off at the center, the girls collaborated to make their younger friend a hybrid soft-toy bag when she asked the older girls for one (Figure 4d). In this instance, that the girls were participating in a STEM-rich e-textile making camp receded into the background, their “circles of kinship” (Moll & Gonzalez, 1994) manifested in community babysitting at Willow was centered. This community-driven need—to take care of and occupy safely, the attention of a younger kin at any given time and space—shaped what the youth spent time on and created, in the moment. In this way, the community was shaping the STEM-rich making processes and social interactions therein.

The second atmospheric wall identified was the wall of hostility and perpetual liminality. Youth discussed how the lack of beauty at the center created an atmosphere of perpetual stress, where one is fixed in position as the perpetual, refugee “other.” As Sloan noted on the opening quote of this paper, the information posted on the walls of the community center are educational. However, these posters (e.g., English alphabet, American currency, mathematical times tables, and elementary science posters, see Figure 8) also constitute an invisible but keenly felt atmospheric wall of exclusion and hostility. These posters, in addition to being educational, constantly served to message to the youth (and whoever might enter the premises) of their refugee status, their otherness, of their lack of foundational knowledge deemed valuable in the host land. These posters as a mosaic wallpaper worked materially to ironically mark and magnify the difference of the refugee community that the center seeks to serve. While it can be argued that the center is serving the refugee community’s needs by aiding the process of assimilation to the host country through these posters, the messaging inherent also suggests that the youth and their families are on an unending journey toward legitimacy, yet never arriving. To Sloan and her friends, creating a big, attention-grabbing piece of electric art for the center would reduce the stressfulness of the center

by diverting the eyes away from the education posters and landlord rules, toward a piece of art that looked like it could be in a family room.

At the center, atmospheric walls were produced and amplified through materiality. The lack of materials in the form of toys, soft-toys and weekend handbags messaged to the youth what the host country deems essential for their well-being—clothes and school bags, but not toys nor youthful accessories. Conversely, the abundance of materials, in this case educational and informational posters, signaled to the youth their perpetual liminality and illegitimacy. In how they engaged with the STEM-rich making program, the youth pushed back on these atmosphere walls materially by creating the artifacts they wanted for an imagined future. How the youth is experiencing “community” at Willow is complicated. While Willow is recognized as a residential complex for recently resettled refugee families and the center is thus organized as the site for centralized services aimed to aid in various aspects of the resettlement process for children and adults in the families, the idea of “community” is de-romanticized when youth make present inequities baked into these services. How, what, and for whom they chose to make for in the STEM-rich making program were directly driven by the characteristics of this community—in their case, what was missing from their community at Willow and the center.

4.4 Finding #2: In creating longed-for and missing artifacts, youth engaged in allied, political struggles and sought for a rightful presence at both the community and in the STEM-rich making program

The STEM-rich making processes facilitated youths' articulation about hidden oppressive practices operating at their community center. While the center is clearly a resource and takes seriously the purpose in supporting newly relocated refugee youth through a range of services, oppressive atmospheric walls stemming from resettlement practices operated via how powerful host allies' prioritized the needs of the refugee youth—daily school backpacks are more necessary than weekend purses, clothing deemed essential but not toys. Education posters are needed resources to boost English language acquirement by refugees, beautiful art, not so essential, as in the case of Willow. What the needs of a refugee community are, how the center ought to provide such services, were primarily determined by stakeholders from the host country.

The youth engaged in counter-shaping the characteristics of the Willow community at the center. By using the human and material resources of the STEM-rich making club to literally create these missing items to meet their neglected childhood and youth needs, the youth engaged in the process of “reterritorialization,” the way in which displaced people and local people establish new or rather expand networks and cultural practices that define new spaces for daily life (Brun, 2001, p. 23). Their reterritorialization toward rightful presence revealed the complex relationships between the physicality and sociality of their resettlement space. The youth are physically bound to spend the majority of their out-of-school time at the community center (due to their limited access to funds and mobility) and receive the services provided there. By agentially leveraging the making resources, both material and social, they sought for a rightful presence by creating the missing items necessary for their and their community's well-being.

To counter the ugliness of the center with nothing but educational and informational posters adorning the walls, youth labored over 6 months to create a large electric art piece to hang at a conspicuous spot at the center, where anyone who walks in the door “can see it right away,” drawing the eye away from the educational posters to something beautiful made by the youth. Their final art piece, which they titled “One World”, consists of 45 individual Spirograph patterns,

15 LED lights in four complicated parallel copper tape circuits, four switches, and renewable batteries. The girls declared their art piece “beautiful.” One World signaled an atmosphere of beauty and hope, a definite push back against the “Perpetual Other” atmospheric wall. Rami, one of the youth, described the piece as such:

“The big red one [largest spirograph pattern] is us, or me. Then the ones around it are my family and closest friends here...we know each other and speak our language. The others are coming to join our community so we are expanding and becoming more together....like us and also our friends in school who were born here. Nobody is leaving...we are coming together. It is one world. I want to expand my world...but still be me.”

In addition to seeking for a rightful presence at the center writ large, youth also sought for a rightful presence in the space of the STEM-rich making program. Their expanding repertoire of making skills and knowledges were tightly woven to the community justice issues they identified. For the older teens with younger siblings at the e-textile camp, in addition to working on their own projects, they also had to help their younger charges, even creating the “stuffed animal/small handbag hybrid” requested by a young visitor. The older youth reauthored the rights of participation in the summer making club: They asked to bring their younger charges along and they asked to make items that both they themselves and their younger charges desired. Centering the rightful presence of familial relationships in the STEM program impacted the STEM-rich making skills they then developed, because of the specificity of the social context that informed what they wanted to make, why, and for whom. Such STEM discipline-specific knowledge and practices included drafting a design on paper, taking into consideration where on the purse or soft-toy to position LED lights, measuring and considering how much room was needed for the circuit in addition to seam allowances, sewing a “clean” circuit, hand sewing and using the sewing machine. With the One World electric art piece, the girls became proficient in building complex, parallel circuits, inserting switches, considering design trade-offs as they explored where to place each Spirograph drawing to make the larger picture. Imbricating the social relational with the technical of STEM-rich making supported the youth in authoring rightful presence in STEM and in their lives in the Willow community. Their identities as recently resettled refugee youth living at the Willow community who are regular participants in the center's STEM program were who they were and who they wanted to be during STEM-rich making sessions, not who they imagined they ought to be -minoritized refugee students who needed to “catch up” on disciplinary science.

We want to note that these acts of seeding rightful presence were contingent on established relationships between the girls and ourselves as STEM program facilitators and tutors at the center. Our presence as allies to both the refugee youth and the Americorp adult facilitators running the center was essential in brokering for the ways in which youth chose to engage in community-driven STEM-rich making. Such modes of engagement—taking on leadership roles and making artifacts to address injustices in the everyday lives of their resettlement process at a community committed to serving refugee families—also gave voice and agency to refugee youth that are missing from the larger discourse what it means to engage in community-driven science for refugee youth.

5 DISCUSSION

5.1 Incubating epistemologies as a making present practice toward rightful presence

Through engaging in allied political struggles and reauthoring their rights at the STEM-rich making club, youth engaged in critiquing injustices in their resettlement process at the Willow community through identifying atmospheric walls, articulating what concerns them in their community and considering and then acting on what could be materially created through their making club to counteract these injustices. After going through the processes of co-identifying and unpacking concerns, they worked together to plan what they could do, using the resources of the STEM-rich making club to address these concerns. All of this took time and were undergirded by sustained conversations, uncertainty and trial and error—the practical manifestations of the youths' and our allied political struggles. We suggest that these struggles brought forth a making present practice (Calabrese Barton & Tan, 2019) that we are describing as incubating epistemologies. We conjecture that incubating epistemologies is a making present practice specific to the negotiations and contentions in figuring out and forming “community” in a hyper-diverse context without shared historicity, as compared to for example, Indigenous communities. Further, incubating epistemologies fostered iterative, dialogic connections between community and community-driven science in ways that produced new characteristics of each, with new artifacts with potential to seed new social interactions and new ways of being.

In the fields of STEM education, epistemologies have often been treated as fixed, agreed upon, or “settled” (Bang et al., 2012, 302), anchored in White western norms and values. However, such a stance “privileges epistemologies that reproduce hierarchies such as race, class, gender, sexuality, and nationality and limit other ways of seeing or imagining possibilities for equity” (Philip & Azevedo, 2017, 527). Justice and epistemologies are ineluctably linked. Whose knowledge counts, what matters, why and for whom, are fundamental epistemological considerations. Adhering to and reproducing a particular epistemology while silencing others is a classic way that White supremacy is upheld in education (Bang & Medin, 2010; Nasir & Vakil, 2017; Tan et al., 2019).

Research with indigenous youth have shown that soliciting for and valuing multiple epistemologies, including indigenous communities' values and relationally-grounded practices related to nature is consequential for indigenous youths' development of robust STEM engagement (Bang & Medin, 2010). In the context of our STEM club with refugee youth living at a residential complex characterized by hyper-diversity (Malsbary, 2016) and with the particular, peripatetic history of refugee families, what counts as community epistemologies as relevant to the Willow residential and community center, is far from clearly rooted. There was a necessity for incubating community-based epistemological threads to become more fully-formed community epistemologies, through sustained engagement with the STEM-rich program in community. For example, how the ugliness of the center, as related to how the walls are ugly, to what kind of vibe a youth gets when walking through the center, to feeling stressed out at the center—are reflective of youths' emerging community-based epistemological work as they simultaneously lived at Willow and spent time at the center during the week and at the STEM program on Fridays. They were asking epistemological questions related to being in community—what matters at this center, why, in what ways, and for whom, and how might STEM in this community be relevant to their everyday experiences. As Sloan indicated, she wanted the art piece to be large enough so that one's eyes are immediately drawn to it on entering the center, instead of gazing at educational posters.

Through incubating such epistemological work, the youth exercised their right to reauthor rights toward establishing a rightful presence. Incubating epistemologies was a way the youth and ourselves as facilitators and researchers worked toward a new consciousness (Anzaldúa, 2007).

The necessity to incubate epistemologies is also a consequence of grappling with ambiguity from existing on borderlands, as Anzaldúa (2007) noted. It took time for the youth to notice and then be able to articulate, that while they appreciate the generous clothing donations, their desire for toys and youthful handbags were valid and justified. It also took time for the youth to name and unpack the deep sense of alienation evoked daily as they enter the center with its walls of educational and rules posters. Incubating epistemologies was a way that the refugee youth we worked with figured out how to ask for changes to the center that would acknowledge and value their youthful humanity. Ambiguity also characterized the STEM-rich making program. None of the youth had encountered the kinds of hands-on science activities and many of them were struggling with science class in school. What it meant to do science in community, why, what counts as STEM/science also necessitated incubation to figure out.

The work of reauthoring rights necessitated the aid of adult allies, a role we took up as STEM-rich making facilitators and established community stakeholders at Willow with strong relationships to other adults involved in the center's work. As facilitators, we actively structured the sessions to be conducive for conversations and for multiple opportunities to play with materials, tools and consider and reject possibilities. Even with this stance, it took time for the youth to test out whether they might risk-taking actions to reauthor their perceived rights. The first 3 months of weekly STEM-rich programming mirrored didactic school scenarios not for the lack of us inviting youth ideas and input but the youth themselves consistently performing “good student” compliance in significant measures. As university researchers and “teachers” representing the host country, the refugee youth encounter and are immediately aware of the formidable power dynamics heavily tilted in our favor, when we are sharing time and space together in STEM club. Merely verbalizing “what would you like to do? What are you thinking you might enjoy?” is insufficient in erasing the atmospheric wall tied to our positionalities as university researchers and host country teacher. Time was also essential for incubating trusted allied political relationships before the youth slowly felt more confident to speak and ask us questions, including about the science content, about STEM-rich making skills, whether Edna (who is Southeast Asian) came to the host country as a refugee, about the citizenship naturalization process. These social interactions directly shaped whose ideas and voices mattered in the community STEM-rich making program as they also impacted who youth could be and the agentic actions they might take, in shaping Willow community through the community STEM program.

Fostering this collaborative approach provided a productive space for youth to mull over, name, and identify perturbing concerns, supporting engagement in political struggles to make injustices visible. Such a process entailed sociopolitical struggle for the youth, and also for us as adult facilitators who had to constantly remind ourselves to be patient in waiting, to not instruct in a didactic manner in the name of efficiency while we wait for a response, to be humble in our positionality as “insiders-outsiders” (insiders who have spent significant time in the community but still outsiders since we are not from the community), to not presume that we know what the youth are still trying to decipher in words and descriptions that which bothers them and how they might respond. These are the concrete actions that acted to tilt the power axis less heavily toward us and more toward the youth, although we are cognizant that power hierarchies in our favor always would remain.

6 THE CULTURAL POLITICS OF EDUCATIONAL EXPERIENCES FOR REFUGEE YOUTH

Discourses surrounding the educational experiences of refugee youth oftentimes sound a discordant chord. Narratives of woeful lack and enduring deficits (e.g., Thabet et al., 2004) are invoked in equal measure with accounts of inspiring agency and empowerment (e.g., Dávila, 2017). Across such inscriptions, refugee youth continue to exist in limbo, consigned to whatever manifestations might result from the shaking out of “multiple registers of rights” (Somers & Roberts, 2008) at their particular context. At Willow center, in terms of refugee youth-programming, these rights have shaken out to mean homework tutoring from 3 to 5 p.m. on Mondays to Thursdays and Fun Friday activities, where the STEM-rich making club is the only consistent programming that day. Fun Friday otherwise meant no tutoring services and the children played outside at the playground on the residential complex or engaged in whatever non-academic activity the volunteers had planned, mostly coloring or art activities for the youngest children. On Fun Fridays, there are also significantly fewer volunteers at the center. Homework tutoring is driven by what schools had assigned and consists entirely of worksheets and reading assigned passages. In the 6 years, we have been there and helped with tutoring, no youth we worked with was assigned any homework that intersected with youths' everyday experiences, familial stories, or home-based resources.

Materially, these rights have shaken out to mean a steady supply of clothing donations, backpacks, and books, from residents of the city. Materials for youthful, leisurely activities such as toys and weekend handbags were conspicuously absent. The educational posters (Figure 8) were purchased by AmeriCorps fellows on the shoestring budget allocated through a university center. The organized tutoring activities, physical arrangement of material artifacts and presence (and absence) of particular materials work in concert toward the goal of “integrating” refugee youth into normalized, White, western school culture. We argue that these social and material arrangements produced a cultural politics that oppressed the youth. Hostile atmospheric walls pressed in, reminding them of their alien status, inscribing and re-inscribing the immanence of their liminality. Atmospheric walls are “how we inhabit the same room but be in a different world” (Ahmed, 2014a, 2014b). The college student volunteers and visitors to the center consistently remark on the wonderful work done there, providing needed services to refugee families. Yet, as the youth age into middle school, we have seen a consistent pattern of them visiting the center less and less, with some quitting its services completely. Some would turn up only for the STEM program on Fridays. When asked, youth offer reasons such as no longer feeling comfortable at the center or that there is “nothing interesting to do there,” losing key friends who no longer want to be there, or how being at the center puts them in a “bad mood.” While there could arguably be a myriad of reasons why, as youth grow up they would visit the center less often during a school week, we conjecture that their increasing absence might partially be related to atmospheric walls there.

We do not in anyway, discount the much-needed services offered at the center. However, we do note the importance of becoming aware of oppressive atmospheric walls, how they are erected through spatiality and materiality, and working to tear them down. This is important when considering justice-oriented support for refugee youth that impacts their resettlement process. Through this process, we also learned with the youth that “community” is a complicated construct. At Willow and the center, there are simultaneously positive and negative aspects to the community through the enactments of various relationships, entangled in the arbitrariness of refugee rights.

As stakeholders of Willow, the youth took action to shape their community with STEM-rich making as a tool.

7 DIALOGICAL SHAPING OF COMMUNITY AND COMMUNITY-DRIVEN SCIENCE

In the making of STEM-rich artifacts, the youth collectively disrupted refugee/host relationalities by materially claiming space for their presence as youth who deserve a full childhood, inclusive of play and recreation, in addition to learning and becoming naturalized citizens of the host country. With the artifacts produced and how youth intended them to be used, they engaged in initial attempts to weaken atmospheric walls by literally claiming space through materiality, shifting the physicality of the center and seeding new social interactions. After One World was completed, permission was granted to move some educational posters off the wall facing the main door of the center, for One World to be hung. The art piece generated many admiring comments from other children and volunteers at the center. In the months that followed after One World was hung on the wall, two new, large posters featuring community members enjoying social activities together were featured next to it (Figure 9). Through incubating epistemologies toward a rightful presence at the center, the youth engaged in “world-making” (Ahmed, 2014a, 2014b), creating a world that is “less hard to inhabit” in one “that does not accommodate our being” (Ahmed, 2014b). Incubating community epistemologies allowed the youth to act from “desire-based” stances, accounting for “the loss and despair, but also the hope, the visions, the wisdom of lived lives and communities” (Tuck, 2009, 417). As Rami poignantly described what One World signifies, “Nobody is leaving...we are coming together. It is one world. I want to expand my world...but still be me.”



Figure 9. One World hanging on the wall of Willow center, with two other posters featuring community members

How the youth utilized the STEM program as a tool to shape their community at Willow reflects their emerging ability to frame their community as not immutable, and that “its present state is one of many possible outcomes” (Gruenewald, 2003, p. 627). We suggest that this nuanced framing of community is contingent on incubating community epistemologies and has outcomes related to what kind of authority which stakeholder might have, to take what actions. These decisions are the building blocks of community making and of community-driven science.

As STEM club facilitators and researchers, we were also impacted by the youths' concerns and insights about Willow as paid attention both to their everyday experiences and a commitment to engage them in robust, STEM-rich experiences. In our context, this commitment to pay dual and dialogic attention in these ways was enormously facilitated by the luxury of time which is a constraint for formal science learning environments. We worked to pay attention to the insider knowledges the youth were accruing as residents of Willow community, to honor their insights and developing community wisdom. Simultaneously, we concretely responded in programmatic ways—procuring materials as informed by youths' decisions on what to make, alongside researching and teaching STEM-rich making skills that were needed (e.g., different stitches for holding different thickness of materials together for the handbags; soldering and how resistors work for One World's circuitry). Our approach is also contingent on the trusting relationships built as a result of engaging in critical participatory ethnography and sharing time and space longitudinally with youth at Willow community. We learned to pay attention to the impact of spatiality and materiality on social interactions and learning, as informed by Ahmed's work on atmospheric walls. We further developed insights on how spatiality and materiality are consequential in allied political struggles for Rightful Presence with refugee youth in community-driven science.

8 CONCLUSION

With the current administration, the United States has encouragingly increased the number of refugees she would receive. With the global refugee crisis, the numbers are likely to be significant. This suggests that understanding how refugee youth negotiate hidden oppressive forces inherent in their resettlement process in hyper diverse communities, even in spaces of support such as community centers dedicated to refugee welfare, is timely and necessary. Investigating how refugee youth can be supported in pushing back against such hidden atmospheric walls through leveraging on specific content-area expertise, such as STEM-rich making, has far-reaching consequences both on refugee youths' continued engagement with subject disciplines in meaningful ways and in their trajectory to establish a rightful presence in becoming full citizens. With the current global and national climate of amplified racial tensions, further investigations into what kinds of allied political struggles, involving whom, necessitating what kinds of practices, where and when, are warranted. This study offers needed insights into how these processes can unfold and the necessary sociopolitical struggles that undergird such.

Endnotes

1 The Karen are a number of ethnic groups with Tibetan-Central-Asia origins, minoritized in rural Burma (<https://minorityrights.org/minorities/karen/>).

2 A federal program where applicants apply for a fellowship committed to serving communities in need across contexts (www.americorp.gov).

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