



Community Infrastructuring as Necessary Ingenuity in the COVID-19 Pandemic

Day Greenberg^{1,2} , Angela Calabrese Barton^{1,2} , Carmen Turner^{2,3}, Kelly Hardy², Akeya Roper², Candace Williams², Leslie Rupert Herrenkohl¹, Elizabeth A. Davis¹ , and Tammy Tasker¹

We report on how one community builds capacity for disrupting injustice and supporting each other during the COVID-19 crisis. We engaged long-term community partners (parents, their youth, and local community center leaders) in on-going conversation on their experiences with the pandemic. We learned with and from community partners about how and what people in communities most vulnerable in this crisis learn about and respond to COVID-19 in highly contextualized ways, individually and through extended family groups and trusted social networks. We report on how they put understandings towards educated, organized, urgent community infrastructuring actions within informal coalition networks. We explore these actions as necessary localized responses to systemic neglect from dominant institutional infrastructures during a global pandemic.

Keywords: collaboration; descriptive analysis; equity; ethnography; in-depth interviewing; parents and families; qualitative research; science education

Although the national narrative is that COVID-19 does not discriminate, it is well established that injustices, perpetrated through decades of local and national economic, health care, and housing policies, have put communities of color at greater risk of infection, complication, and death. Yet, the field knows little about how people make sense of COVID-19, including the intersections of the science of COVID-19 with justice-related concerns. Further, long-standing inequities and forms of systemic oppression in the United States have exacerbated the impact of the disease on people of color, low-income people, immigrants, and other vulnerable groups.

Pandemic as Context of Continued Injustice

Since late March 2020, we have been engaging in critical ethnographic conversations with youth and parents in one urban community in the Midwest with whom we have collaborated for more than a decade. Many of us call this community home. We live here, raise children here, and work here. This community, which is predominantly Black and low income, resides in a state where infection and death rates rose early and dramatically, especially among our Black community members. Although the

gubernatorial response was quick and strong despite lax federal guidance, there has also been political backlash led by White supremacists.

We share here insights from data gathered in our long-term midwestern partnership during March and April 2020, the early phases of the U.S. pandemic. We learned with and from community partners about what people in communities most vulnerable in this crisis learn about COVID-19 and how they respond in highly contextualized ways, individually and through extended family groups and trusted social networks. We witnessed youth and adults actively co-construct, leverage, and redistribute crucial life-supporting knowledge and resources, deciding and acting with personal, family, and community care in the forefront. Drawing from decade-long relationships, long-form participatory interviews, and documents shared by participants and parent co-researchers, we engage the term “community infrastructuring” to understand new collective forms and impacts of necessary ingenuity and care. As individuals and community

¹University of Michigan, Ann Arbor, MI

²Midwestern STEM Collective, multiple locations, Michigan

³Boys and Girls Club of Lansing, MI

groups envision what learning and living can look like and produce, their continued critical work can inform wider efforts against the reproduction and deepening of educational inequality caused by COVID-19.

Approach

Our study is guided by theories of consequential learning and critical justice. We work to center learning that matters to people now and toward imagined social futures (Gutiérrez, 2012) as opposed to learning that matters to external institutions. We are particularly concerned with how locally valued learning processes involve disrupting and transforming dominant patterns of participation toward new forms of expertise and social relations. These theories uncover and interrogate how such learning is shaped by power and people's positionalities across time, place, and scales of activity (Jurow & Shea, 2015).

Understanding decision making and action taking as socially, economically, racially, and otherwise contextualized is central to expanding opportunities for justice-oriented social futures (Morales-Doyle, 2017). For example, family members' particular social and economic roles (e.g., jobs in essential industries) can be both mandatory for personal and family survival and dangerous in terms of viral transmission. Likewise, immediate needs for food, shelter, and supervision of youth or elders require daily risk/benefit analyses mandating complex understandings of scientific data, socioeconomic data, and how those data interact. We seek to understand people's sensemaking of this pandemic and their related action within a consequential context that acknowledges the interwoven impacts of this reality. Such an acknowledgement necessitates deeper engagement with the political and ethical dimensions of learning, often neglected in the study of how people learn, in order to build more complex and justice-centered understandings of that learning (McKinney de Royston & Sengupta-Irving, 2019).

We also employ a historicized and future-oriented ecological and participatory approach to give witness to and learn with our community partners to capture the fullness and potentials of experiences (Gutiérrez et al., 2017; Villenas, 2019). This requires commitment to centering and amplifying participant voices as opposed to centering researcher voice, placing importance on methods such as open-ended interviews with co-determined protocols and co-analyzed findings.

This manuscript reports on initial findings from the first month of a larger study documenting what and how people learn about the COVID-19 pandemic in real time and how they activate this knowledge toward informed decision making. This larger study involves 60 participants across two metropolitan areas representing different geographic regions of the United States (30 from each city, 15 youth and 15 adults). Participants for the work reported in this essay were recruited from our mid-western collaborative involving very-long-term, sustainable research-practice partnerships with multiple community-based institutions. This manuscript includes eight middle school youth, five parents, and two community members, all of whom reflect the racial demographics of their community, Black ($n = 11$) and Biracial ($n = 4$). The first two authors have been embedded in this community for eight and 14 years, respectively, as

after-school science, technology, engineering, and mathematics (STEM) educators, program leads, and critical ethnographic and participatory researchers. The third author is a community center director, and the second and third authors cofounded the collaborative together in response to the need for more community-centered educational programming in the neighborhood. Three authors (Authors 4, 5 and 6) are parent partners in our collaborative.

We used a combination of remote participatory interviewing via phone and videoconference tools with document collection, such as videos, screenshots, images, and links. Fifteen semistructured interviews, lasting between 90 and 276 minutes (some split across multiple days), addressed topics including what COVID-19 information individuals access, how, and why; how individuals contextualize and apply COVID-19 information toward decision making; personal and community COVID-19 experiences; and use of resources and social networks. We co-analyzed data with participants using critical inquiry/grounded theory in a constant comparative, continuities/contradictions approach (Charmaz, 2017).

Community Infrastructuring as Necessary Ingenuity

We offer initial insights revealing how individuals engage in community infrastructuring—justice-oriented acts of necessity to share and reorganize resources in the moment and with an eye toward the urgent near future. We remix Penuel's (2019) concept of school and district infrastructuring (redesigning relations and routines of practice for resource sharing and sustainability) to consider urgent everyday life applications of infrastructuring for community protection and well-being. By shifting "infrastructure" from a noun to a verb, like Penuel, we call into question the typical definition of an unchanging, rigid, or final system of processes and practices. In our case, when a community collectively engages in resource reallocation and new resource and knowledge development during a global pandemic, new critically informed and healing forms of infrastructure (e.g., education and knowledge sharing, food production and distribution) can trace over the gaps in publicly available support.

A new appreciation for the collective and collaborative ontologies of infrastructures opens up new possibilities for recognizing the ingenuity of communities. This approach is consistent with other fields, including design theory, where scholars have revisited assumptions about how designed objects are used in light of new and unexpected uses of artifacts, actions, interactions, and languages (e.g., Binder et al., 2011). The emergent and distributed nature of human-infrastructure relations can resist and challenge original design goals, assumptions, and rules or norms. New envisionings and co-creations that better serve human needs and desires become possible. For example, when a community of practice (such as a school community or, in our case, a community of families and friends across nearby city neighborhoods) redesigns uses, forms, and movements of resources, the power dynamics of resource gatekeeping can shift or flip.

Infrastructuring, from our remixed perspective, works to redress injustice. It also involves creating conditions that support

community members in innovating as they organize to disrupt injustices. Deepening the definition of infrastructuring in this way, then, questions the dominance of the power holders who initially built structures of practice and interaction. It opens up possibilities for considering porosity, movement, and transformation in ways that allow for democratized actions and redistributions as well as whole redesign and restructuring toward ideals of restorative justice. The idea of infrastructuring helps to uncover the strengths and forms of expertise communities of color and low-income communities leverage *every day* toward surviving and thriving, despite living within structures that were not designed to serve them or their loved ones.

In this study, community members produced and applied complex and contextualized socioscientific, political, racial, and socioeconomic understandings toward educated actions we refer to as community infrastructuring. Families engaged in this community infrastructuring within informal coalitions of localized networks among fellow community members to support shared resiliency and regeneration of community resources within a trusted network of “people who care.” *This form of ingenuity was as necessary as it was transformative.* We argue these political and ethical dimensions of families’ COVID-19 learnings are essential to informing any justice-oriented educational response during this and future urgent life contexts. Although we report our results using past tense, it is important to remember that the pandemic, and thus our data collection, are ongoing; our participants continue to learn about COVID-19 and make decisions based on their learning.

Gathering, Sharing, and Producing Socioscientific Understandings

All participants interviewed during the first month of our state’s self-isolation order were knowledgeable on COVID-19 scientific concepts. Parents and youth were (and are), for example, aware of the seriousness of its symptoms and spread. One mom explained, “I’m just doing what I can do at home to flatten the curve.” Another stated, “This is why I tell you to wash your hands [and] cover your sneezes because just because you can get over it doesn’t mean that the next person can.” Many kept updated on new evidence of contamination pathways, new protection recommendations, and even environmental impacts of self-isolation. For example, one 13-year-old followed news on reduced pollution levels via Snapchat, informing complex feelings about the virus:

I have a love/hate relationship with it because it’s helping the earth in more ways than one. At the same time, people are dying... But then there’s good things, like about the oceans clearing up, the dolphins coming back, and everything being more cleaner.

Access to evidence-based knowledge about the virus was widespread, as participants who checked social media or email were inundated with continual Centers for Disease Control and Prevention (CDC) and World Health Organization (WHO) updates via banner-type public service announcements. One 14-year-old added,

I’ve noticed that any app I’m on gives you [official CDC] links to head to, to learn about corona. It’s with the weather app I have, also with YouTube, anything I get on... the first thing it says is, “Learn the facts about COVID-19.”

All parents discussed strategies for teaching children correct protocols for protection, and all participants used multiple, newly popularized science terms during interviews, such as “spread,” “curve,” “isolate,” and “contaminate.”

Many of the parents’ and youth’s COVID-19 understandings were developed within a critical political awareness of how local and national politics shape what it means to know science in this pandemic. For example, many highlighted conflicts between sources (e.g., presidential briefings vs. CDC guidelines), being careful to point out how misinformation campaigns foster deepening racial and socioeconomic injustices. One mom shared,

Trump will be talking, and all the experts will be behind him shaking their heads. I’m like, no, don’t tell people that. You’re not saying that correctly. Him calling it the China virus, I want to punch my TV. You’re just creating racism at that point. Let’s not do that.

Although parents discussed following local pandemic news via TV and Twitter (especially statements from their governor), both youth and parents said they regularly checked CDC or WHO sites directly, citing a lack of trust in information from the White House. One parent said she learned more science in the past 6 weeks than “probably all of high school.” She also noted that she has learned to be “careful” in analyzing what she hears because it has become “really obvious” to her how politicians can use statistics for their own agenda. She explained that her 23-year-old daughter helps to keep her updated on “actual data” coming from the county health department. Her daughter added,

I’ve watched the news in the last few months more than I have in my entire life. I tried to see what information I could piece together from YouTube, Instagram, TikTok, and more traditional news sources, like online news publications and local channels. Information about how the virus spreads and the symptoms changed so quickly, it was difficult to keep up. Dr. Fauci is the GOAT [popular youth acronym meaning “greatest of all time”], and I can’t help but think about how much better the U.S.’s pandemic response would be if the federal government listened to his suggestions.

She explained that getting information from “multiple sources,” and especially from “sources with autonomy” (sources not depending on pleasing funders, like cable network CEOs), gains importance as different sources share different types of information from different perspectives, giving her “a better understanding of where we are” in the pandemic.

Further, as community members gained new knowledge on the virus and contexts of the pandemic, they shared it via text, FaceTime, and apps including Facebook (adults), Instagram, Snapchat, and TikTok (youth). Many indicated that social media news updates were less anxiety provoking than TV news because

newer technologies' structures support emoting, connecting, and sharing positive updates with loved ones.

Applying Knowledge in Action

Our second finding highlights how community members applied critical understandings of science in life in resilient and ingenious ways (e.g., Gutiérrez et al., 2017), engaging in new community infrastructuring actions. This includes actions to *share and strengthen resources* and actions to *support critical consciousness co-development*.

Resourcing. Infrastructuring actions were (and continue to be) built around urgent concerns about job insecurity, unemployment, and household bills. They included new resource-sharing strategies, as resource acquisition became more difficult. In many cases, for example, extended family members combined living arrangements to streamline resource sharing while increasing safety. But this also increased parental guilt and stress about restricting children's movement and crowding personal space within smaller-than-ideal living quarters.

Parents also explained how they identified different community members who had access to, or knew how to access, much needed resources, including food, sanitation supplies, and medicines. One youth described her aunt as her extended family "plug" (trusted contact) for toilet paper and hard-to-find groceries. In another example, one mom described using her deep-freezer meat storage and local farm contacts to address widespread meat shortages:

I was telling my friends, we do have a pig and some cow, if you can't find any beef. It's making me feel more generous about it. It's not even me, it's my dad's, but I'm like, y'all need some pork chops? I feel more generous about it. If anybody needs some help, I love to help.... Like what do I need to do? Put me in, coach!

Such ingenuity and generosity has become more necessary in a dearth of institutional structures of support to cushion pandemic-related hardships disproportionately placed upon Black and low-income communities. Concerns about viral spread have been complicated by the resource impact of the pandemic on everyday infrastructure, such as disruptions to public bus schedules and store hours and loss of work-related income. As another mom explained about her neighbors' food insecurity, inequity worsens the pandemic's effects:

This is what happens in a small, low-income community... [that] has a food desert. People who take the bus, who can't take the bus right now, who are supposed to be social distancing, can't get to [the store]... They're stuck with what they have.

Not having the same access to resources for survival was widely discussed by participants as an injustice issue related to race and access to money and/or power.

Critiquing and responding. Infrastructuring actions also focused on building and using structures for supporting a critical

education around how this pandemic is playing out in racialized, socioeconomic, and power-mediated ways. Parents do so in support of their children's (and their own) continued learning and also to fight the anti-Blackness they witness accompanying much national and local political talk about the pandemic.

For many, the pandemic has become a new lens for identifying and critiquing specific injustices. One youth, for example, shared what she had learned about economic inequity as a context for understanding different dimensions of the pandemic: "Lower-class people... don't have fancy benefits and things that could get them through this pandemic. They have a job and that's all." Another critiqued the public's seemingly willful blindness to the pandemic's racial injustice: "I just felt like it wasn't a coincidence that after reports about how hard it hit the Black community, that White people started saying it's not a big deal." A third shared what she took from witnessing mask-dismissing individuals storming her city's capitol building with weapons:

I learned that maybe some people don't need assault rifles. I have a feeling that they're going to be sick and maybe that's what they need, to learn they should not do ignorant stuff like that. I've decided to try to wear my mask way more. Spray my bike with Lysol. Since other people aren't trying to be safe, I need to be extra safe.

Parents reported seeking creative ways to support such youth knowledge building and critiquing of complex socioscientific injustices. One mother shared how she enriched her children's home learning:

I use a lot of definitions that are things they're learning right now, so "essential," "pandemic," "virus," but I included a lot of things I don't think they were learning at school.... We learned about "discrimination," "race," and, you know, "fairness" and "opportunity" and "credit" and "debt" and all these things I think will ultimately tie into them understanding why this [pandemic] affects a lot of areas the way that they do.

Many parents also discussed with their children how this pandemic was affecting particular classmates differently based on socioeconomic access, helping them to consider what they could do for their friends' families. These turns toward local action echo what every participant shared: A lack of trust in larger organizations of power to do the right thing has solidified determination to act and care in localized ways.

As misinformation and anti-role models continue to act in this pandemic while traditionally recognized knowledge bodies (schools) remain closed, alternative pathways of questioning and co-constructing knowledge have taken on an even more important infrastructuring role. For some, like the parent creating at-home vocabulary lessons, this pandemic offers an opportunity to educate on racialized dimensions of global socioscientific events, dimensions that often go unrecognized and unaddressed in classrooms. It's also an opportunity to use technology as a tool of resistance against dangerous abuses of power. One youth demonstrated this when she Googled data on increased calls to poison control centers following Trump's suggestion to inject disinfectants as a viral preventative. "I don't trust any of them," she added about current national leaders.

The alarming spread of racist and classist propaganda related to the COVID-19 pandemic has likewise raised urgency to critique and collectively disrupt neoliberal (nonsystemic) narratives about why people contract COVID-19 and how the country is working to prevent spread. One youth emphasized critical thinking and collaboration as preventative measures against the pandemic spiraling into a more violent scenario. Comparing a potential near-future dystopian class war over resources to *The Hunger Games*, she stated, “That could really happen to us. They make us separate by class and fight against each other. . . . That scares me.”

Discussion and Conclusion

The youth and adults in our community partnership continue to be deeply engaged in community infrastructuring efforts as they continue to learn the science of COVID-19 and its justice-related complexities. Community members have been engaging in systemic critiques and work to resource and defend their communities against injustices during this pandemic, describing efforts as organized and urgent responses to a lack of support and to understanding many dominant infrastructures as working against their well-being during a national public health crisis. As they do so, they challenge what it means to know, to educate, and to act with complex knowledge of COVID-19, echoing Gutiérrez et al.’s (2017) call to re-see youth and communities’ knowledge engagement as legitimate ingenuity. These newly imagined and enacted community infrastructures shift the boundaries of STEM and civic participation, as youth and parents alike see themselves as trustworthy and caring community experts on the pandemic.

The prefix “infra-” translates to “under,” as in an infrastructure is literally an under-structure upon which human practice and interaction is constructed and maintained. What types of practices and interactions are accepted and shared as legitimate among members of a community depend on what underlying infrastructures support and legitimize as central to a community. When structures in power fail to acknowledge or support practices and interactions necessary for a community’s survival, however, individuals and collectives of individuals within that community must seek to co-create alternatives. The very foundations upon which learning and living occur must be rethought, resisted, and disrupted. In this study, such co-creation of alternative infrastructures for survival has been organized in a type of underground resource sharing and social support toward shared resiliency and regeneration. Within a trusted network of “people who care,” individuals are coming together to co-create new infrastructures that could better serve their needs.

Engaging in this collaborative study on the political and ethical dimensions of how people learn about the COVID-19 pandemic puts into stark relief the sometimes clashing ethics of doing research in a pandemic. Working remotely, as regulated by our universities, on what families are learning *with* others in their community, without support from schools, to *stay alive* undergirds a relational dimension of *critically being with* in research (Villenas, 2019) that is often made invisible—indeed, problematically made absent—in traditional institutions of learning. How researchers and participants come together,

engage, and co-construct knowledge in real time and in urgent local and global contexts, using a wide range of media and access points for communication and community storytelling and counternarrative, must become a more urgent consideration for the field.


Drawing insights from these initial findings, we suggest that in this time of national distrust of political leaders, the education field needs more platforms for amplifying counternarratives and supporting dialogue on new forms of flexible, mobile, and immediate infrastructuring in local communities. This could highlight community strengths and shift the ways in which we frame literacy in STEM in relation to everyday life.


NOTE

This work was supported by the National Science Foundation under Grant DRL2028370.

ORCID IDs

Day Greenberg  <https://orcid.org/0000-0003-0615-6236>

Angela Calabrese Barton  <https://orcid.org/0000-0002-9555-5214>

Elizabeth A. Davis  <https://orcid.org/0000-0002-4984-0209>

REFERENCES

- Binder, T., Michelis, G. D., Ehn, P., Jacucci, G., Linde, P., & Wagner, I. (2011). *Design things*. MIT Press.
- Charmaz, K. (2017). The power of constructivist grounded theory for critical inquiry. *Qualitative Inquiry*, 23(1), 34–45. <https://doi.org/10.1177/1077800416657105>
- Gutiérrez, K. D. (2012). Re-mediating current activity for the future. *Mind, Culture, and Activity*, 19(1), 17–21. <https://doi.org/10.1080/10749039.2011.632056>
- Gutiérrez, K. D., Cortes, K., Cortez, A., DiGiacomo, D., Higgs, J., Johnson, P., Lizárraga, J. R., Mendoza, E., Tien, J., & Vakil, S. (2017). Replacing representation with imagination: Finding ingenuity in everyday practices. *Review of Research in Education*, 41(1), 30–60. <https://doi.org/10.3102/0091732X16687523>
- Jurow, A. S., & Shea, M. (2015). Learning in equity-oriented scale-making projects. *Journal of the Learning Sciences*, 24(2), 286–307. <https://doi.org/10.1080/10508406.2015.1004677>
- McKinney de Royston, M., & Sengupta-Irving, T. (2019). Another step forward: Engaging the political in learning. *Cognition and Instruction*, 37(3), 277–284. <https://doi.org/10.1080/07370008.2019.1624552>
- Morales-Doyle, D. (2017). Justice-centered science pedagogy: A catalyst for academic achievement and social transformation. *Science Education*, 101(6), 1034–1060. <https://doi.org/10.1002/sce.21305>
- Penuel, W. R. (2019). Infrastructuring as a practice of design-based research for supporting and studying equitable implementation and sustainability of innovations. *Journal of the Learning Sciences*, 28(4/5), 1–19. <https://doi.org/10.1080/10508406.2018.1552151>
- Villenas, S. A. (2019). Pedagogies of being with: Witnessing, testimonio, and critical love in everyday social movement. *International Journal of Qualitative Studies in Education*, 32(2), 151–166. <https://doi.org/10.1080/09518398.2018.1533148>

AUTHORS

DAY GREENBERG, PhD, is a postdoctoral research fellow at University of Michigan, School of Education, 610 E University Ave., Ann Arbor, MI 48109; and an after-school mentor at the Boys and Girls Club of Lansing, Michigan; daygr@umich.edu. Her work focuses on

critical participatory STEM and maker research and design with youth, their families, and community organizations.

ANGELA CALABRESE BARTON, PhD, is a professor of the learning sciences and science education at the University of Michigan, School of Education, 610 E University Ave., Ann Arbor, MI 48109; *Angiecb@umich.edu*. Her research focuses on justice-oriented participatory science, technology, engineering, and mathematics teaching, learning, and engagement in schools and communities in long-term partnerships involving teachers, community members, and youth of color.

CARMEN TURNER, BA, is CEO of the Boys and Girls Club of Lansing, 4315 Pleasant Grove Rd., Lansing, MI 48910; *cturner@bgclansing.org*. Her work examines local/national responses to the pandemic in underserved communities as well as innovative collaboratives with community partners around education.

KELLY HARDY, mother of two, associate of business administration, licensed cosmetologist, is an AMSI and Entrata assistant coordinator for a property management group, and a freelance hair stylist; *hardy1837@gmail.com*. She chose to participate in the research project from a single working mother's perspective pertaining to a community whose local and federal leaders were underinformed, were undereducated, and lacked preparedness during a growing global pandemic.

AKEYA ROPER, high school graduate; medical assistance certification; medical terminology, coding, and billing certification, is employed at Capital Internal Medicine Associates, Haslett, MI; *akeyaroper@gmail.com*. Her reason behind doing the COVID project is to be able to share her story and her experience of what she and her kids have learned and seen from the pandemic from both working/nonworking parents and the losses that have occurred in this time.

CANDACE WILLIAMS, high school graduate, is an employment specialist at Express Employment Professionals, 1429 West Saginaw Hwy, East Lansing, MI; *candace.rw@yahoo.com*. Her reason for wanting to do the COVID project is to be able to share what she has learned as a mother of two during the pandemic.

LESLIE RUPERT HERRENKOHL, PhD, is a professor in the learning sciences and science education and in the combined program in education and psychology at the University of Michigan, School of Education, 610 E University Ave., Ann Arbor, MI 48109; *leslierh@umich.edu*. She partners with practitioners to design and study holistic and equitable learning in science within and outside of formal school settings.

ELIZABETH A. DAVIS, PhD, is a professor of science education at the University of Michigan, School of Education, 610 E University Ave., Ann Arbor, MI 48109; *betsyd@umich.edu*. Her research focuses on how curriculum materials and teacher education experiences can support the learning of teachers, with a focus on elementary science teachers learning to engage in equitable, just, and authentic science teaching.

TAMMY TASKER, PhD, is a postdoctoral research fellow at University of Michigan, School of Education, 610 E University Ave., Ann Arbor, MI 48109; *tqtasker@umich.edu*. Her work focuses on supporting equitable and rigorous learning for all and at all levels.

Manuscript received May 19, 2020

Revision received July 8, 2020

Accepted August 4, 2020