# Black Children at Play: The Cultural Practices of the ILLEST Lab

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Imagine a makerspace deliberately designed to maximize creativity and inspire racially minoritized participants, especially Black children, where they can freely explore all levels of creativity. At the heart of the chapter, we are looking to address the open nature of makerspaces and allowing Black students the flexibility to iterate, prototype, and fail without While equity and access in makerspace environments have begun to be areas of focus within the informal learning research community, more research is needed that investigates the types of engagement. Particularly for Black students, discussions of equitable access are followed by the interrogation of tools, curriculums, and design of the learning environment. However, there is very little around the creative exploration and collaborative relationships fostered by participation in the makerspace. In this chapter, I am looking to address the open nature of makerspaces and allowing Black students the flexibility to iterate, prototype, and fail without consequences.

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In this study, I describe cultural practices at the ILLEST Lab that support creative play and exploration for the Black student participants. The ILLEST, which stands for Informal Learning Linking Engineering Science & Technology, is a university-housed makerspace open to both university and school-aged residents of West Philadelphia, which is a Promise Neighborhood. The ILLEST was designed as a call to action where students in the West Philadelphia community could collaborate and engage in STEAM practices through a multigenerational environment, free of expectations and assessments, allowing them to be stewards of their STEAM engagement.

The ILLEST houses 3D printers, turntables, power tools, 300 pairs of sneakers, a flight simulator, and a 10-foot poster of Kermit the Frog wearing a Supreme box-logo T-shirt. The creation of this space is part of a purposeful accumulation of culturally responsive and curated resources set to become the foundation for a cornucopia of maker projects. The activities in the ILLEST were designed to provide students with flexibility and creativity to produce projects such as designing and engaging a 3D printer to create prosthetic limbs, testing the latest sneaker technology, or designing a chemistry experiment based on the optimal combination of coconut and essential oils to provide the maximum level of hair-moisturizing protection against humidity on a warm spring day. The centralized goal of the ILLEST is to support culturally responsive creative thinking (CRCT) that embraces Black students’ social contexts as a foundation for the transfer of STEAM competencies and their project-based activities.

## Transgenerational Counter Space

The ILLEST was designed to function as a counter space to the accepted traditions of makerspaces and making cultures. The foundation of the ILLEST was based on a desire to dispel the many examples of cultural bias documented by women and racially minoritized participants. A power dynamic exists between the creators and participants of makerspaces (Vossoughi et al., 2016), where curriculum, projects, and tools are used to set cultural norms (Halverson & Sheridan, 2014). The benevolence of STEM opportunities can subjugate participants, which in turn perpetuates and continues an uneven power dynamic (Sengupta-Irving & Vossoughi, 2019). This power dynamic can be referenced as an unspoken or invisible power over participants and the environment. The design of a STEM environment reveals a great deal about its creators’ values and potential aspirations (Martin, 2014).

By not providing Black participants with an environment that embraces creative and design flexibility, makerspace creators are trafficking in the benign neglect of resources and power (Sengupta-Irving & Vossoughi, 2019), using this group’s conditions to reinforce a single direction of power that ultimately fosters a deep lack of creative empathy. Makerspaces are not frictionless environments, but in this research, I integrate the tensions of the cultural practices of established makerspaces and the latitude of racially minoritized participants to be creative and simply play.

The ILLEST Lab is a transgenerational learning makerspace integral to building upon youth-centered cultural practices. It is defined as transgenerational because of the fluid generational leadership found within the lab. The intentional design of transgenerational participants is so that knowledge and creativity are accessible to all participants within the space. Experts with advanced knowledge and skills and newcomers with limited knowledge and skills all become contributors to the construct of a learning community with members from various levels of STEAM experience, knowledge, and skills. At any point, middle school students can be mentored and led by a high school student, who then seeks the advice of undergraduate engineering students supervised by Ph.D. or postdoctoral students.

According to previous studies, the benefits of generational differences heighten retention and creativity for participants (Sánchez & Kaplan, 2014; Tillinghast et al., 2017; Bers, 2007). The differences in participants’ generations can also expose variations in attitudes and life experiences. For a makerspace designed for a particular minoritized group, it also highlights nuances that ultimately dismiss the monolithic identity that has been attributed to Black students. The ILLEST welcomes these differences and builds on the transgenerational dynamics in teaching and learning, which builds a creative and interaction-rich learning environment, a key component of community building and learning (Sánchez & Kaplan, 2014).

## Theoretical Framework

### Play as a Form of Resistance

At the heart of play-based learning is the opportunity for young people to explore and experiment not just individually but in a collective learning environment (Yahya & Wood, 2016). Early childhood education research frames of play-based learning around experimentation and reflection (O et al., 2014) but falls short of the discussion around the cultural practices and norms for minoritized participants (Yahya & Wood, 2016). The belief that all children have an equal opportunity is problematic, especially when Black students are less likely to be allowed to do play-based learning compared to their white peers (Ford et al., 2008). Allowing Black students the flexibility to engage freely with new objects, concepts, and project-based activities provides a critical lens on play-based learning. Black students have voiced frustrations with not being given opportunities for unstructured interactions with STEM learning tools and objects. Research on cultural practices of white students in STEM environments yields a different reality, where students are allowed unstructured play to engage and master new tools and resources without restrictions (Shmukler & Naveh, 1985). My position is that allowing Black students the opportunity to engage in unstructured play is an act of resistance against the traditional practices of play-based learning. There is potential for identity alignment and harnessing creativity for Black students.

 As active learning environments (Bean et al., 2015) in which students use an array of learning expertise to shape skills in real-world design applications, makerspaces have galvanized educators and research (Hira et al., 2014). Yet, a tension for makerspace design ethos is the neglectful application of foundation-inclusive and culturally relevant principles to help support a diverse population (Vossoughi, 2014). Cultural modeling sits at the nexus of design and cultural practices within makerspaces.

Dr. Carol Lee’s cultural modeling supports the direct discussion of encouraging students’ everyday knowledge in content-specific learning spaces (Lee, 2003). At its core, cultural modeling (CM) allows researchers and educators to create a routine inventory of students’ practices during out-of-school activities and engagements (Lee, 2007). This curation provides beneficial insight into students’ cultural and cognitive practices, specifically in their community settings (Lee, 2014). The key to CM is creating an opportunity for educators to map students’ lived experiences and skills onto domain-specific content areas, topics, and procedures across the learning setting (Lee, 2008). Cultural modeling was designed using research on student learning, expert-novice studies, and human development. Dr. Lee used CM to inform the interdisciplinary field of learning sciences while making a persuasive case for the inclusion of culture and cultural practices in the understanding of human learning.

Informal out-of-school makerspaces are a popular resource, providing students an opportunity to learn and engage in both active learning and building community (Bowler, 2014). Yet, empirical research around makerspaces has found the collaborative and learning narratives to be rife with continued biases and equity concerns (Halverson & Sheridan, 2014), particularly for racially minoritized participants (Sengupta-Irving & Vossoughi, 2019). In a 2013 presentation at a FabLearn conference at Stanford University, Dr. Leah Buechley declared: “The Maker movement has grown large enough and influential enough that it’s time to turn a critical eye to the culture of the community, what we want it to be and what it really is.” Critiques of makerspaces and the movement are increasing in both the academic and classroom communities, with the stated purpose of making sure that the community looks inward and fulfills the stated transformative promises (Sheffield et al., 2017).

The research critically examining makerspaces beyond the disruptive narrative and dismantling force has been led by critical pedagogists and social justice-minded academics who firmly believe in the potential of these informal spaces. Yet, makerspaces have never been portrayed as counter spaces to the hegemonic powers that govern STEM special interests (Vossoughi, 2014). Counter spaces present themselves as alternatives to the mainstream philosophies of learning, engagement, and production (Ong et al., 2018). Many makerspaces have a running ethos around competitive success and computer-integrated activities, which often reflect the normative behaviors of white male scientists or engineers (Edouard & Kim, 2017). The counter-narrative around makerspaces relies on assessing students’ activities, where testing takes a back seat to the activities’ learning and project-based creation. Each is the selling point in the test- and data-heavy education landscape that has presented itself over the last 40 years. Makerspaces counter data and testing norms by providing an evangelist-style unifying language around disruptions, innovation, and technological tools (Dougherty et al., 2016).

However, role power, time, and unstructured play in the makerspace are missing in the research narrative. For many who have found themselves on the outside of the makerspace, there is this question: Who specifically defines the ethos of creativity and engagement in a makerspace? Interdisciplinary critical pedagogists and learning scientists have zeroed in on the power dynamics surrounding the design and formation of makerspaces (Sengupta-Irving & Vossoughi, 2019).

## Methods

### Participants

Included in the study were five Black high school students from the West Philadelphia area, with one being female and four males. The participants were all juniors and attended five different high schools. Each high school had the distinction of being a magnet school with access to a makerspace, science, and vocational labs. Participants learned about the study by word-of-mouth recruiting conducted by one primary participant. This student, Alan, had attended previous sessions at the university for three years prior. Alan indicated that he knew of other students he could recommend that would benefit from participating in activities in the ILLEST Lab. After two weeks of emailing and contacting each of those students, the five students were assembled. The group initially met at the lab, where they met with faculty who explained the space and asked if they would like to attend weekly. Upon agreement with the weekly attendance aspect, students were given consent forms and asked to get permission from parents to be in the lab space for participation and research. Students attended open lab hours at the ILLEST Lab from October to April. Each arrived at the space, taking public transit from their high schools around the city. The students attended an open lab session for two hours, from 3:30 p.m. to 5:30 p.m. At the lab, two Black female graduate students, one Black male engineering student, one Middle Eastern engineering undergraduate student, and one Black assistant professor supported the participants during the open lab hours. These students also have engaged in multiple formal and informal STEM and makerspace experiences. They also created various makerspace projects and entered into competitions for scholarship opportunities. We selected these five students because they exhibited a high drive and technical proficiency in makerspaces.

### Research Method

This empirical study primarily used observation and journaling of the participants within the ILLEST, a university-based makerspace. These observations focused on how students self-organized within the group, made decisions and selected potential projects. Upon arrival, students were asked to give interviewed reflections on their activities during the day at their respective school sites, with questions focused on activities in their local makerspaces. We looked at observations of group interactions, how they demonstrated content knowledge, and the selection of projects.

Our observation was centered around each Wednesday session, where the five participants and the five mentors interacted with each other. The first month was a collective meetup, where the conversations around ordering the pizza allowed each lab member to build a deeper connection with one other within the space. The first month let the mentors identify some of the making competencies the participants knew. They did this by asking probing questions about the tools and activities each of the five engaged in at their respective makerspaces. These non-structured questions were positioned to allow the students to openly share their experiences with a larger group to see if there were commonalities, allowing the researchers to pinpoint if there were through lines and reoccurring themes. As the relationships with the group began to develop over time, the decision was made over the following two months to pair each participant with a mentor. These pairings were decided by how the students began to ask direct questions to particular mentors and build affinities for their works. Ultimately, the goal was to pair participants with mentors who inspired them. We also collected data by providing students with a journal to use on and off-site. The goal was to have students document ideas, inspirations, and personal feelings. We initially kept a strict journal writing requirement upon arrival to the lab to document the day’s goals and write for five minutes at the end of the day. The key was to combine the observations, interviews, and journaling to achieve a wider picture of their activities within the ILLEST Lab.

Part of our observation was to better grasp how the participants brought prior knowledge from their makerspaces and how it was being integrated with the interactions at the ILLEST Lab. One of the first things done was to map their language around the tools within the space. We observed if they correctly named the tools and if they could correctly reference the tools within the lab. We also paid close attention to how the participants were teaching each other about the correct usage of the tools and if there were alternative ways of using the tools within the lab. Through observation and journaling, we set out to find if the students could connect the scientific and mathematical foundations with the activities in the makerspace. For example, when building the circuits, we observed how the students used Ohm’s Law correctly to engage in a project. Our observations also allowed us to monitor how students looked up new vocabulary and terms using internet searches to help them better understand a particular science or engineering concept. We only used observation to get at the heart of the competencies because early on in our interactions with the students, they expressed that they felt uncomfortable answering questions they felt were trying to expose their lack of knowledge. Asking interview questions on concepts posed a challenge as the students made it clear that in their respective makerspaces, they were consistently being quizzed and felt singled out as opposed to their white counterparts.

Part of the open nature of the ILLEST Lab for this group of participants was giving them free rein to select, design, and construct a project for their six-month duration. This was a considered option, primarily based on the early interactions with the students, where they made it evident that they were not allowed to have a voice in the overall project selections at their respective makerspaces. The students expressed that not being able to select or have a voice in the selection of their maker projects made them feel unvalued at their respective makerspaces. Using observations and curating their produced artifacts, we began to map how long each mentor-mentee group would think about a project, design, and create an order list. We documented the conversations across the various months and took photos and videos of the paper prototyping of their initial project designs. Each pairing began the process of creating a parts list, which would be ordered through the ILLEST Lab and delivered for them to begin their projects. We also documented the emails and digital conversations between the pairings while the participants were off-site as they continued to prepare for the projects. Ultimately, due to the winter and spring holiday breaks, there were gaps in the ordering and completion of the projects. However, the main part of the data collection was surrounded by the creative process of the pairings, focused on the participants themselves and their agency toward their maker project.

## Findings

As the year ended, some participants expressed joy in being in a space that provided them an open family-style environment to engage in science and engineering. For many participants, continuing to attend the after-school program became difficult due to other commitments. As we sorted through the data, we realized that two particular students stood out as having 100% attendance and provided a thoughtful insight into their feelings and what took place at the ILLEST Lab. The difficulty of getting all of their voices shared in our findings came down to the difficult decision of picking the two dominant voices to help provide insight into our findings. Each student provided a clear discussion about gender and racial barriers that they found in their respective makerspaces and how the ILLEST Lab provided a space to help explore and navigate these tensions.

### Unstructured Play in the Role of Social Interaction

Darius, a participant, would come into the ILLEST expressing the need to rest and recover from a long day at school. Ultimately, he wanted an opportunity to relax, engage, and be open, which was one of the fundamental things missing at the makerspace in his school. “Yo, they just always pressuring me, and I don’t know how I feel.” At his school’s makerspace, Darius explained that they discussed his need to be in some form of leadership, as few racialized minority students participated. He did not want or feel comfortable starting in a leadership role and wanted first to be a part of the community and learn. “I just never was given an opportunity to kind of just you know, find myself and really be able to understand my role.” This sentiment was a constant theme from Darius when discussing his struggles with being placed in a leadership role.

When asked if he felt he was being pushed or singled out, his answer was very direct: “I think they just want to give me some type of opportunity to say something. But that’s just not me.” In his interview, Darius talks about how his identity formation had not yet flourished or been given the opportunity to grow.

When asked how his experience at the ILLEST differed, Darius provided a contrasting set of realities, stating, “When I come here, I can just chill. Maybe get something to eat and then think a little bit with my friends.” A community was starting with the four other participants. Darius, who was familiar with the other four participants before coming to the ILLEST through other communities in and around Philadelphia, felt it was important that he started to build community with his peers.

Multiple times throughout the months, Darius was found discussing music, comic books, and the latest sneakers he wanted to buy. Seldom Darius was asked to get back on task or asked to produce a deliverable. During an interview, Darius highlighted this engagement: “It seems that in this space, you guys don’t sweat me as much. You allow me to kind of figure things out.” There is a particular discussion around the flexibility of the space to give him time and opportunity to feel confident at the ILLEST.

Darius was allowed to develop and create some ideas for a group project. One such project was designing and creating an electric bicycle. Particularly, Darius wanted to design a mode of transportation that had a sustainable energy approach. He explained that in his other classes, they talked about sustainable energy and access to sustainable resources to help better the planet. Darius immediately thought about his commute and how potentially all the buses he would ride emit toxic chemicals. If he could transport himself to and from school using an electric bicycle, he could add to the discussion of a sustainable and healthy planet.

These discussions continued to be generative as Darius discussed building a better community in Philadelphia. He saw the makerspace and all the tools within it as an opportunity to engage in these developments. Using the lens of bettering his community, Darius found himself at the center of not only the making community but also being able to use the tools, processes, and content knowledge he gained within the space to design and create products to help better his outside community.

On many occasions, while talking with his peers at ILLEST, Darius applauded his access to plentiful resources. “At our makerspace at our high school, we actually have to check out certain amounts of resources, but I sometimes think it might be unfair because some of the white kids they get to check out more than me. And I don’t think that’s cool.” Darius addressed the potential inequity between the access to resources at his high school and the ILLEST. He felt that while he was asked to be a leader at his school’s makerspace, he was still not given the same flexibility as his white peers regarding access to resources. It is important to observe the language around identity and the potential identity to be developed in the makerspace when the participants are positioned or charged for engaging in the makerspace when it comes to time and access to resources.

### Play that Allows for Creativity

“Really, sometimes I don’t feel that my opinion matters. And most of the time, people just keep speaking over me.” Jessica was the only female participant. She is one-half of a twin. Her twin sister was supposed to be a participant in the ILLEST but was given another opportunity. She recommended that her sister, who was also heavily interested in engineering practices, take her place at the ILLEST. Initially, Jessica was apprehensive and resistant to joining the group as she would be the only female within the space. She expressed concern that her voice would not be given an ample platform to share and engage in any activities.

Jessica was given time to meet and acclimate to the environment. Her observed behaviors began to show some of her previous struggles and feelings while at her school’s makerspace and other informal spaces before being at the ILLEST. In an interview, Jessica shared the following,

A lot of times, we are asked to rush through our activities, and I'm not given enough time to be able to just think about what it is I want to do. So what happens a lot of times is that my group members forced their opinions on to me in order to meet a deadline. I become uncomfortable and just agreed to get along.

Jessica made it very apparent that this kind of atmosphere at her school was not conducive to her being creative and developing ideas within the makerspace.

 As her time at ILLEST went on, she highlighted the differences in her peer groups and the overall energy within the space, stating, “What I noticed here with all these guys is that they don’t feel pressure and therefore they’re not giving me pressure. We just kind of sit here, play and laugh, and talk about music and food. I like that.” Jessica highlights how the environment and the atmosphere allow her to build with her peers and lower anxiety when designing and creating projects within the makerspace. She chose different activities to engage in to better familiarize herself with the tools and some of the technical competencies required to navigate throughout the ILLEST. She shares, “Honestly, what’s cool here is that we can play, and it just helps me think of random things.” Being able to navigate the ILLEST openly allowed Jessica to piece together possibilities and options to create afforded to her peers at her school’s makerspace. It would seem that Jessica, as an African-American young woman, found a peer group and an environment that allowed her to have a voice and develop an identity within the space where she could be the steward of her own making potential.

## Discussion

In this study, we explored how Black students were provided the opportunity to engage in a learning-focused makerspace without the constraints of time and a mandate for deliverables. We selected high-achieving students and placed them in a low-stakes environment with access to an infinite amount of college resources to see how they would engage with space and each other. Our research found that the students were initially intimidated by the opportunity to navigate openly and explore the environment and tools. Over the three months, five students effectively self-organized and self-taught on the machines and tools in the makerspace. Students had minimal access to instructor scaffolding and were allowed to use cell phones, laptops, and tablets to search and lookup any technical expertise required to run a machine or design a project.

### Observation within the Space

Observing the language and the physical movement using tools and resources allowed the researchers to see how an open, unstructured makerspace can be relevant to forming identity and sparking creativity. The students clarified that race and gender played roles in how they felt and saw their identity development in the makerspaces. Darius explained how using resources was inequitable compared with his white peers. Jessica raised gender concerns as the pressure to complete tasks and engage in activities pushed her voice further to the side, as the boys in her group were dominant in shaping projects to reach deadlines.

For our research, we looked to create and facilitate discussions around allowing Black students to engage in a culturally relevant makerspace environment freely. Our findings call on makerspaces to prioritize Black students’ experiences to join in unstructured play. Unstructured play within makerspaces requires further investigation to understand different cognitive and cultural practices needed to maximize the experiences and creativity of Black participation in makerspaces.

## Conclusion

At the heart of this chapter, we aimed to understand better what drives creativity and agency for Black student participants in a makerspace. What was ultimately uncovered was that the design of the environment was the most important aspect. Things like the type of background music the mentors available to them who had roots in the local community. This approach was a fundamental part of design where you have to make underrepresented students feel that their presence is not only welcome but at the center of the design and creative process that takes place within a makerspace.

One of the first recommendations was to ensure Black mentorship was visible and present to give the participants something to aspire to. The mentors were specifically from the academic and career pathways the students aspired to participate in. We were also intentional in having gender representation within the space so that the Black female participants could feel a sense of connection in a male-dominated space.

What we observed from conversations, journaling, and the project artifacts was that when we created an open, non-competitive environment, the students’ anxiety levels decreased, and they felt like there was less likelihood of punitive consequences of iterations of their project. Two students made it clear that at their school, having a finite set of resources did not allow them to prototype as often as they would have liked, and it became a competition for who had the best idea voted on by the group to move on to the prototyping stage.

At the ILLEST Lab, students were encouraged to prototype and not take access to resources as a barrier. What was surprising was asking students to select their projects did not yield a completed design. The trouble from our observations was that the students were not used to having so much freedom and say in their projects. Multiple times, participants would explain that they were happy and welcomed the agency to select their projects. But at the same time, they could not produce a final product.

The researchers concluded that 1) time on task was limited due to the once-a-week nature of the lab, and 2) the students had high expectations of themselves and wanted to impress their mentors. One student expressed that she did not want to disappoint or let down their mentor, so the participant wanted to think of the perfect project to express gratitude. It seemed the anxiety built up from the students’ prior interactions in other makerspaces still played a role in how they engaged at the ILLEST Lab. It was as if their unsuccessful participation in other settings still presented a barrier, even in a supportive environment. A recommendation would be for designers of makerspaces to consider participants’ anxieties and past traumas when selecting and designing projects. Doing so should help make the students feel empowered. The hope is that this chapter provides nuance when having discussions around the participation of Black students in makerspaces and that at the forefront, creativity and agency are at the center of providing generative opportunities for participants who have been traditionally shut out of STEAM fields.

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