18. Holding Values in Tension in a Technology-Enhanced Afterschool Club

ROBBIN RIEDY, KELSEY TAYNE, AND A. SUSAN JUROW

Abstract: In this paper we reflect on our experiences designing for and supporting learning in a technology-enhanced making and play-based afterschool club. We examine various tensions related to the values we wanted to support in this making space, such as tensions between providing access to rich experiences and environmental sustainability and between valued technology practices. We draw on critical approaches to care to understand our design and facilitation decisions as we grappled with these tensions.

Introduction

There are often competing aims within a given learning setting (Coburn, 2004). When designing learning spaces, educators must balance multiple learning goals and values. While it is clear that multiple, potentially conflicting, goals are the norm, it is not always clear how educators go about deciding which learning aims to pursue and which values to emphasize in design work and facilitation. Critical theories, such as critical care (e.g., Rolón-Dow, 2005; Thompson, 1998), as well as a critical reflection on computer science education (e.g., Booker, Vossoughi, & Hooper, 2014), provide resources for thinking through the many tensions that educators will inevitably face. We draw on critical approaches to computer science (CS) education and a critical understanding of caring taken together to reflect on values and practices in a technology-supported, play-based after-school club that emphasized making. We examine tensions in values regarding our design and facilitation of learning in this space and consider our own reflections and learning as designers and facilitators working toward more humanizing approaches to technology-supported education.

In collaboration with our research team, we noticed certain tensions between access to rich technology and making materials in the learning environment and supporting practices of socioenvironmental sustainability. We grappled with how to provide for expansive making opportunities while knowingly contributing to a culture of consumption, production, and waste. We also found that the kinds of technology and materials, and the ways of engaging with them that we were valuing as designers and facilitators, were sometimes in tension with the practices related to technology use, play, and creativity that children wanted to bring into the club. While we examine these values in tension in one making space, these are enduring tensions that emerge across makerspaces. As a community supporting rich learning with making and CS, it is important that we examine our practices and support each other in creating learning environments that are rooted in critical care.

Critical Computer Science and Critical Care

Recent calls have asked educators and designers of learning environments to take a critical perspective on the learning goals and values embedded in technology and computer education (e.g., Booker et al., 2014). To take a critical approach is not necessarily to adopt a skeptical or negative position, but rather to critically examine the historical influences of unequal power relations and the influences of racism, sexism, classism, cultural hegemony, and other oppressive forces on the development of a particular field (e.g., Carspecken, 2013). Critical CS does this by posing questions regarding whom technology education is for, what purposes it serves, and who benefits. Caring from a critical perspective similarly

reiterates the need to account for how race, privilege, and power influence the way that classroom participants give and receive care. Scholars who advocate for this model of care argue that caring must go beyond simply being nice to students in the classroom, but also must include a concern for the community that children come from (e.g., De Royston, Vakil, Ross, Givens, & Holman, 2017; Rolón-Dow, 2005; Thompson, 1998). Lines of work in the field of critical CS and critical care have included critiquing the framing of the maker movement as White and male, a framing that can ignore or erase the deep history of making practices that happens in nondominant communities (Vossoughi, Hooper, & Escudé, 2016), pushing back on the traditional workforce justifications for teaching technology in the CS for All movement (Philip, Gupta, Elby, & Turpen, 2018), and advocating for caring that goes beyond academics and takes the whole person into account (Rolón-Dow, 2005; Thompson, 1998; Valenzuela,1999).

Using critical CS and critical care, we examine design tensions in this makerspace. Tatar (2007) described design tensions as the mismatch created between vision and approach, the difference between what is and what ought to be: "Tension could be constituted by a dichotomy between two goals, or by a continuum, or by the relevance of two or more incommensurate forces" (p. 445). Exploring these tensions within the club allowed us, as Tatar suggested, to reflect on trade-offs, insights, and the ways in which the club could be reformulated to accommodate differing values.

When placed in conversation with each other, critical caring and critical CS suggest that as educators and designers of technology-enhanced making spaces, we must be concerned with more than whether or not the children we work with are learning to use the tools we bring into a learning environment, but rather, (a) to what ends these tools are used, (b) what values are being supported, and (c) how are we demonstrating genuine and holistic care for young people who enter these spaces. We see these as important questions for any designer or facilitator of a makerspace to grapple with.

When we asked these questions of ourselves and our own makerspace, we found multiple answers. For instance, opportunities for access to future STEM careers was one important goal for technology use at this club, but at the same time, we resisted the idea of supporting learning around technology simply to develop a future workforce. While designing for new ways of engaging with making and technology to support the repertoire of practices available to children, we also wanted to specifically design for and facilitate learning that served the desires and dreams expressed by the children themselves. Additionally, we struggled with tensions between supporting wide forms of engagement with (and consumption of) technology and other making materials, while seeking to engage more socioenvironmentally sustainable forms of making and learning. What follows are two bricolage vignettes or composite stories (Solórzano & Yosso, 2002) of common events that took place at the club over the course of a semester that highlight the multiple values enacted by the various participants, and the ways in which we attempted to hold these values in tension.

Context

The EPIC afterschool club is the heart of a long-standing university-school partnership that serves as a site for teacher education (Freeman & Jurow, 2018). The partnership is an intentional approach to organizing and studying equity (Gutiérrez & Vossoughi, 2010). The aims of the partnership between the School of Education at the University of Colorado Boulder and Sanchez Elementary School are multiple: supporting robust learning opportunities for children from nondominant communities and organizing equity-oriented teacher education. The club is a local iteration of the Fifth Dimension model, a type of school and university partnership that was originally developed at the University of California, San Diego (Cole & the Distributed Literacy Consortium, 2006; Nicolopoulou & Cole, 1993). Common to Fifth Dimension programs is activity across two main settings: a university course in which students study sociocultural theories of learning and an afterschool club for elementary students, which serves as the required practicum for the course, founded upon those same theories of learning. Core values of EPIC include play, equity, and side-by-side learning between children and facilitators.

EPIC operated in the school's large, open cafeteria with folding tables and chairs, and play at the club included both the use of "low-tech" resources (i.e., paper, pencils, cardboard) and "higher-tech" ones (i.e., iPads, Chromebooks, laser cutters, radio transmitters). The kids who participated in the program ranged from second to fifth grade and came from a number of different racial and ethnic backgrounds. Many of the children who participated in the club were Latinx (many students were of Mexican descent). Club participants valued hybrid language practices and we tried to promote multilingual communication. An aim of the club was to disrupt traditional power imbalances between kids and instructors (Freeman & Jurow, 2018). In different semesters, club participants would explore themes (i.e., superheroes, futurism) as a means of creating space for children to play and reimagine alternative futures. Children, undergraduates and graduate students, and university faculty worked together to imagine, design, and build for potential futures.

Two of the authors of this piece were graduate student facilitators, and one was the principal investigator. We also worked with a larger research team that included other club facilitators, instructors of the university course, and our primary partner at the elementary school, the director of the afterschool program. Together we met once or twice per week to design and reflect on what was happening in the club and the university course. It is with our research team that we grappled with these ongoing tensions, and we expand on these conversations here.

Design Tension 1: Balancing Access and Sustainability

> Kids are using LED lights to make greeting cards that light up in designs of their choice. The students talk about showing their cards to younger siblings and to their parents; however, the graduate facilitators cannot let the students take the cards home without first sending a note letting parents know that coin cell batteries are used in the cards, and that they should be kept away from younger children and pets. Most children leave their cards at site, so they sit in the supply closet until the end of the year, when they are recycled. As soon as the kids are finished with their cards, a few children begin to ask to make slime. The undergraduates prepare a space for making the slime by getting paper bowls, plastic spoons, and a plastic tablecloth. As some kids make slime, others make ice cream in Ziploc bags using ice and rock salt, at a table covered in a plastic cloth. Kids with hands sticky from slime or ice cream take turns washing up in the restroom around the corner as everyone tries hard to make sure to avoid staining the tables or the floors of the cafeteria, a community space shared by the entire school. Kids and undergraduate partners begin to clean up at some of the tables, throwing away construction paper, plastic bags, salt, copper tape, and several large unfinished crafting projects made of popsicle sticks, glue, cardboard, and pompoms.

Although we valued providing access to rich and varied materials, we found tension in a philosophy of making that values high levels of consumption and equates access to a wide variety of materials with supporting rich learning opportunities. We contest this consumerist approach as the basis for deep learning, yet we also value youth engagement with materials that support them in creative and meaningful making. Taking a critical approach to technology use forced us to reflect on the human and environmental costs of our tools (Bonds & Downey, 2012). In making and using technology with racially and linguistically historically marginalized communities, with many youth who were living in poverty, we also thought it was unjust to emphasize the need for material waste reduction at the potential expense of young people's access to materials that support their goals for making—especially considering the fact that our project had funds to buy the materials that that kids wanted to use and that the *vast* amount of material waste around the world is produced by more dominant communities. We wanted to provide as many opportunities for exploration as possible, while using resources wisely, as well as recognizing the often unacknowledged (often female) labor that goes into creating many of our electronics in sometimes harsh conditions (Arriola, 2000) and the disproportionate impact of technological waste on women and people living in the least developed countries (McAllister, Magee, & Hale, 2014).

We recognized that we were providing a model to the children for how to think about and use technology, and yet we realized that many clubs ended with at least one bag of waste from our making materials. Additionally, each semester, we would throw away materials to make room for new ones because we had limited storage space at the school. We sometimes worked with electronic materials (micro:bits, batteries, LED lights) that had a one-time use and were then thrown away.

This design tension between consumption, sustainability, access, and equity caused us to reflect on our practices. Inspired by other groups who were doing work around making and resource repurposing (e.g., the Watsonville Environmental Science Workshop), and making that challenges "problematic constructions of materiality seeped in human entitled nature-culture relations leading to unsustainability" (Barajas-Lopez & Bang, 2018, p. 8), we began design work toward increased sustainability in our material practices. We held our values in tension by encouraging multiweek, ongoing design work, and we attempted to more deeply incorporate planning into the process of design so that students began projects they were more likely to find greater meaning in and see to completion. We did not limit children who did want to use new materials each week, but rather we encouraged ongoing iterative design work. With electronics, we attempted to design for multiple projects that could incorporate the same micro:bit in different forms so that children could iterate with the same electronics for new projects. We also tried to move away from purchasing bulk materials at the beginning of the year and instead tried to purchase materials that were specifically requested by children, rendering that material more meaningful for the child. This allowed students to work with the particular materials they wanted while also reducing the waste we produced. However, this is an ongoing tension in our space and other makerspaces that must be confronted if "makerspaces are serious about transformative and equitable learning" (Barajas-Lopez & Bang, 2018, p. 8).

Design Tension 2: Valued Technology Practices

> The children are working in groups of two or three, alongside their undergraduate partners. Some groups of children are using small sewing machines to make pillows, onto which they will eventually glue or sew LED lights. Another group of children and undergraduates are playing a board game, made of paper, glue, clay, and markers, which the kids had made in a previous day at the club. An undergraduate uses her phone to take a picture of the game to help jog her memory when it is time for her to write field notes for the university course later that week. A small group of girls is making friendship bracelets, while an undergraduate student sits nearby to help. On the other side of the room, an undergraduate student sits patiently beside a child who is using an iPad to watch videos of games and music. The undergraduate gently cajoles the student to join one of the other groups in working on a project. Some students sit on the floor in the corner, listening to music on a cell phone, while a graduate student attempts to entice them to join a project group. Two or three of the children ask an undergraduate to take them outside so that they can meet some of their other friends and play on the swings.

Although there was varied technology present at the club, used in innovative ways by the children, there were tensions surrounding which technological tools, and which uses of those tools, would be most valued in the club. In the computer science world, "making" can be more valued than "consuming" technology, "high-tech" tools, play, and skills can be viewed as more worthwhile than "low-tech" ones. At the club, these tensions arose when children wanted to use tools such as iPads and cell phones to listen to music, play games, or communicate with others and when the kids wanted to engage in low-tech (or "no" tech) play.

We typically designed for different forms of technology use, particularly coding with micro:bits, designing LED greeting cards, and making radio transmitters; however, some students were drawn to using forms of technology that were either not part of the main activity or were at times against the rules of the school space, such as using cell phones

or tablets to play music, watch videos, or communicate with others. We wanted to support students' engagement with different forms of technology and value how children wanted to participate with technology. We wanted to both leverage the practices children were bringing in and also engage kids in new making and CS practices with which they were unfamiliar. We sometimes "pushed" children to participate in different forms of making, and in particular forms of making that involved computer science, as we wanted to pursue equity, in part, through access to societally valued CS practices. However, at times the children did not want to use technology at all. Some kids wanted to play outside and in those cases, it was also important for us to pay attention to what the children actually needed in each moment, even if that meant ignoring planned activities with specific technologies for the day. For example, after a schoolday filled with standardized testing, some of the children wanted to spend their time on the playground. It was important for us as facilitators and designers to consider what the children needed and to value play even when it was unstructured and technology free.

While we experienced tension as facilitators, our ultimate goal was to design the space with kids' own problem posing and solving in mind, not just because we wanted them to be engaged and to have fun, but because we hoped to create spaces for heterogeneous, culturally sustaining learning opportunities. We wanted to design against a learning environment that was rooted in monocultural practices, that dismissed various ways of knowing, or that focused on production above all else (Rendon, 2011). To avoid practices that further colonized spaces, bodies, minds, and ideas (Tuck & Gaztambide-Fernández, 2013; Tuck & Yang, 2012), we worked to value the different ways that children wanted to use technology and play, and we aimed to help kids make meaningful connections to their interests and their environment while engaging in play. We reflected on historical power imbalances in the production and use of technology and pushed back against notions of CS learning simply for future employment purposes.

Teaching technology for the sake of creating future workers, at the expense of learning for self-actualization and democratic engagement, creates a narrow definition of learning. An emphasis on job creation fosters a narrative that promotes outreach to diverse communities, rather than "the critical examination and potential reorganization of the activities and pedagogies themselves" (Vossoughi et al., 2016, p. 214). We wanted to provide access to valued technology practices, while not encouraging a workforce-focused orientation to CS skills. We hoped to push kids to try something new, while also respecting their need to run outside and play. We tried to balance these tensions within the twice-weekly, two-hour sessions in which we worked with the children. Ultimately, we landed on a series of trade-offs. Kids could use the facilitators' phones and iPads for certain purposes. For example, we asked some children who wanted to film with a cell phone to help document their friends' projects and interview other kids about what they were making. Cell phones were also used to support the kids in creating stop-motion and scary movies. We made efforts to integrate varied forms of technology in different ways, including cell phones, tablets, and computers to access information, look up instructional how-to videos, listen to music, shoot and edit clay animation movies, and film skits. Sometimes we packed our soldering irons and LEDs away and went outside to spend time together in the sun. We acknowledged the value placed on STEM careers, but instead of focusing on "employability," in terms of training children to take directions or complete tasks, we emphasized kids' roles as agentic creators and problem posers. We still experienced conflict, but we minimized these instances by trying to incorporate these technologies into the club in a way that maximized children's agency whenever possible. Our desire to facilitate in this way was not conflict or tension free, and for us facilitators it was a continual learning process, but we thought it was worthwhile to struggle with the complexity in hopes of better serving our EPIC kids.

Discussion

Bang and colleagues (Bang, Faber, Gurneau, Marin, & Soto, 2016) wrote elegantly about the potential for axiological innovations in education, changes in what counts as "good, right, true, and beautiful" (p. 2), to shape how learning takes

place. By centering the multiple values held in tension at the club, we were able to reimagine what counts as "good" in technology education. Critical reflection helped us better support the values of students from minoritized communities in our designs. Designing and planning for EPIC meant refusing to see the multiple, sometimes competing, values as *binaries*, but instead to find ways to address the complex mix of needs for everyone in the space. We tried to avoid accepting some assumptions that we have encountered, such as technology is always good and should always be used, or that coding is the most important technology skill for students to learn. Through considering our vision for technology use that was situated in children's practices, that helped kids explore, and that built off their interests and experiences, we reflected on ways to reimagine what counted as technology education and why it was important. We did not want to convey to students that they needed to learn these skills *only* so that they could one day contribute their talents to the global economy. Rather, we aimed to provide some additional tools and experiences that supported them in interpreting, expressing, and creating their everyday experiences and shaping their worlds. Caring for the children in the club involved taking learning, above and beyond academics, into consideration. It mattered to us that the kids in the club saw their technology use as meaningful in their lives outside of the school doors. A critical caring perspective also meant sometimes abandoning the use of technology altogether in order to meet kids where they were.

In this paper we considered our own learning as designers and facilitators of learning in an afterschool club. We gave accounts of several design tensions that arose as we reflected on learning goals and values, as we worked to incorporate critical perspectives on technology education and caring into our pedagogy. Taking a critical perspective on technology in the makerspace, as well as a critical approach to caring, placed historical inequalities and power in balances at the center of our pedagogical concerns. This approach required us to consider who technology is for, what ends justify its use, and what multiple values may be in play. It meant considering *why* we wanted kids to learn particular things in the club. We held several aims in mind, providing access to STEM learning for youth underrepresented in the field, supporting technology use as a method of self-expression and agency, and modeling good stewardship of material resources, all while having fun.

References

Arriola, E. R. (2000). Voices from the barbed wires of despair: Women in the maquiladoras, Latina critical legal theory, and gender at the U.S.-Mexico border. *DePaul Law Review*, 49(3), 729–816.

Bang, M., Faber, L., Gurneau, J., Marin, A., & Soto, C. (2016). Community-based design research: Learning across generations and strategic transformations of institutional relations toward axiological innovations. *Mind, Culture, and Activity*, 23(1), 28–41. https://doi.org/10.1080/10749039.2015.1087572

Barajas-López, F., & Bang, M. (2018). Indigenous making and sharing: Claywork in an indigenous STEAM program. *Equity & Excellence in Education*, 51(1), 7–20.

Bonds, E., & Downey, L. (2012). Green technology and ecologically unequal exchange: The environmental and social consequences of ecological modernization in the world-system. *Journal of World-Systems Research*, 18(2), 167–186.

Booker, A. N., Vossoughi, S., & Hooper, P. K. (2014). *Tensions and possibilities for political work in the learning sciences.* Boulder, CO: International Society of the Learning Sciences.

Carspecken, F. P. (2013). *Critical ethnography in educational research: A theoretical and practical guide*. New York, NY: Routledge.

Coburn, C. E. (2004). Beyond decoupling: Rethinking the relationship between the institutional environment and the classroom. *Sociology of Education*, 77(3), 211–244.

Cole, M., & the Distributed Literacy Consortium. (2006). *The fifth dimension: An after-school program built on diversity*. New York, NY: Russell Sage Foundation.

De Royston, M. M., Vakil, S., Ross, K. M., Givens, J., & Holman, A. (2017). "He's more like a 'brother' than a teacher": Politicized caring in a program for African American males. *Teachers College Record*, 119(4), 1–40.

Freeman, Q., & Jurow, A. S. (2018). Becoming a more disruptive teacher. In E. Mendoza, B. Kirshner, & K. Gutiérrez (Eds.), *Power, equity, and (re)design: Bridging learning and critical theories in learning ecologies for youth* (pp. 35–52). Charlotte, NC: Information Age.

Gutiérrez, K. D., & Vossoughi, S. (2010). Lifting off the ground to return anew: Mediated praxis, transformative learning, and social design experiments. *Journal of Teacher Education*, 61(1–2), 100–117. https://doi.org/10.1177/0022487109347877

McAllister, L., Magee, A., & Hale, B. (2014). Women, e-waste, and technological solutions to climate change. *Health and Human Rights Journal*, 16(1), 166–178.

Nicolopoulou, A., & Cole, M. (1993). Generation and transmission of shared knowledge in the culture of collaborative learning: The Fifth Dimension, its play-world, and its institutional context. In E. A. Forman, N. Minick, & C. A. Stone (Eds.), *Contexts for learning: Sociocultural dynamics in children's development* (pp. 283–314). New York, NY: Oxford University Press.

Philip, T. M., Gupta, A., Elby, A., & Turpen, C. (2018). Why ideology matters for learning: A case of ideological convergence in an engineering ethics classroom discussion on drone warfare. *Journal of the Learning Sciences*, 27(2), 183–223.

Rendon, L. I. (2011). Cultivating una persona educada: A sentipensante (sensing/thinking) vision of education. *Journal of College and Character*, 12(2). https://doi.org/10.2202/1940-1639.1788

Rolón-Dow, R. (2005). Critical care: a color(full) analysis of care narratives in the schooling experiences of Puerto Rican Girls. *American Educational Research Journal*, 42(1), 77–111.

Solórzano, D. G., & Yosso, T. J. (2002). Critical race methodology: Counter-storytelling as an analytical framework for education research. *Qualitative Inquiry*, 8(1), 23–44.

Tatar, D. (2007). The design tensions framework. *Human–Computer Interaction*, 22(4), 413–451.

Thompson, A. (1998). Not the color purple: Black feminist lessons for educational caring. *Harvard Educational Review*, 68(4), 522–555. https://doi.org/10.17763/haer.68.4.nm436v83214n5016

Tuck, E., & Gaztambide-Fernández, R. A. (2013). Curriculum, replacement, and settler futurity. *Journal of Curriculum Theorizing*, 29(1), 72–89.

Tuck, E., & Yang, K. W. (2012). Decolonization is not a metaphor. *Decolonization: Indigeneity, Education & Society*, 1(1), 1–40.

Valenzuela, A. (1999). *Subtractive schooling: U.S.-Mexican youth and the politics of caring*. Albany: State University of New York Press.

Vossoughi, S., Hooper, P. K., & Escudé, M. (2016). Making through the lens of culture and power: Toward transformative visions for educational equity. *Harvard Educational Review*, 86(2), 206–232.

Acknowledgments

We could not have done this work without the support of many people and institutional partners. Thank you to our collaborators on the CU-Sanchez EPIC team, specifically Aaron Guggenheim, Max Hollingsworth, Jovita Schiffer, and Ben Shapiro. The University of Colorado Boulder provided funding and time for us to do this work. Thanks to CU Boulder's School of Education and the Office of Outreach and Engagement for their continued support of EPIC. This work was also supported by the NSF Grant 1722504 (Developing High-Tech, Low-Cost Making Projects to Enhance Computational Teaching and Learning). Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation.