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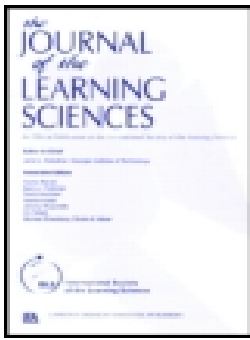
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ARTICLE



# Cyborg sociopolitical reconfigurations: Designing for speculative fabulation in learning

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## ABSTRACT

**Background:** Everyday digital technologies play an important role in mediating human activity that is socio-political and humanizing. The everyday cyborg engages in speculative fabulation that is about fantastical new world-making in times of multiple crises. The work presented in this article builds on previous projects that have examined how everyday cultural practices mediate consequential learning that is transformative for communities of color.

**Methods:** Two social design-based studies draw from ethnographic analysis of two teacher education courses as well as two after-school programs focusing on digital fabrication and making and tinkering. Participants included 22 undergraduate pre-service teachers and 10 middle school students from schools in Latinx communities.

**Findings:** Collaborative cyborg activity, where expertise is distributed, emerged as pre-service teachers and youth collectively engaged with everyday socio-political issues. This article highlights cyborg socio-political technical reconfigurations, where learners assembled ideational and material tools to craft objects of learning activity that went beyond those established by schooling and imagined new possible futures.

**Contribution:** Designing learning ecologies for the everyday cyborg, in this case pre-service teachers and non-dominant youth, fosters an engagement with everyday dilemmas in ways that serve as catalysts for further learning and the new world-making of speculative fabulation.

## ARTICLE HISTORY

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## Introduction

My earliest memories of my *cyborgness*—an augmenting of my body with technology—are as a twelve year-old helping my father in his small gardening business. I took such pride in my lawn-mowing, lawns that belonged to affluent homes in what were widely regarded as the “nicer, richer, and whiter” neighborhoods of my hometown of Salinas, California. I would begin my task with the gas-powered edger whose spinning metal blade would frame the lawn. I would then use the hand-held leaf blower to blow the clippings I had just made with the edger onto the lawn. Finally, I would use my favorite walk-behind Kubota mower—a pumpkin-colored steel body with a two speed drive—to cut the grass into an esthetically pleasing pattern. As a *cyborg* engaged in everyday labor, I switched between tools, to make a mark in spaces where our labor as Latinxs was welcome, but where our communities did not belong. I contend that this illustrated agency as I reconfigured myself with tools in order to take action and to make myself be known even in the most mundane of practices. Indeed, even as my brownness was invisibilized, I made myself and a story about myself (a *fabulation*) visible through my care, my craft, and artistry, an agentic and sociopolitical move.

As cyborgs (combinations of organic and human-made components), our everyday lives are characterized by enhancing our bodies to mobilize within and transform our worlds. This article’s engagement with the cyborg centers our responsibility to each other and the world around us, natural and human-made (Haraway, 2006, 2013). Today, we live in the age of the everyday cyborg where cutting-edge digital technologies, specifically, allow us to instantly connect and to share knowledge in order to take action in the world but also to author narratives of our present and future. Across what I call cyborg reconfigurations is the centering of stories that we decide to tell about our individual and collective selves—what Hull & Katz (2006) call narratives of “agentic selves”—and how we leverage these stories to craft new possible ideational and material worlds.

In the following exploration of the everyday cyborg, I also center considerations in speculative designs of new possible futures that privilege the hopes, dreams, and desires of young learners (Banu, 2015), especially on the heels of multiple global pandemic and social unrest. It is in the active design of the kind of world that learners want to see that consequential and powerful learning happens (Jurow & Shea, 2015). Everyday cyborgs from historically marginalized and oppressed communities are especially adept at engaging in what I see as *cyborg speculative fabulation*, which is characterized by an augmentation of their bodies to carve and craft glimpses of hope and possibility in what Haraway (2014) describes as “worlding ‘naturaltechnical’ worlds [. . .], worlds needy for care and response” (p. 242). Indeed, on the

heels of a global pandemic and social rebellion, the world is in need of healing, and in the following I examine how fabulation that is characterized by *Cyborg Sociopolitical Technical Reconfigurations* are part of the learning and development that non-dominant learners engage in designing toward a healed world and sustainability of its human and more-than-human inhabitants.

The research questions that inform the following article are as follows: 1) How do in-the-moment cyborg configurations index moves toward transforming social conditions in a learning ecology saturated with digital fabrication tools? How are these renderings of new social conditions speculative? In the following, I will begin with situating the concept of the *everyday cyborg*. This section will review the literature related to cyborg theory as it intersects with the learning sciences. I continue with theoretically and methodologically framing an analytic for examining how everyday cyborgs engage in practices that mediate learning and development in a world in need of repair. Here, I will lean on the notion of the *historical actor* in order to interrogate how non-dominant youth use digital technologies to historicize and organize for new futures (Gutiérrez et al., 2019). The findings section will present two vignettes from two social design-based projects (Gutiérrez & Jurow, 2016; Gutiérrez, 2011) where undergraduate pre-service teachers and non-dominant youth engaged in activities as part of a university-community collaboration and centered the use of digital technologies and digital fabrication tools. I will conclude with the implications of designing for everyday cyborg speculative fabulation in teacher education and beyond.

## The everyday cyborg

We live in the age of the *everyday cyborg*: the blurring of our biological and technical embodiments in the action-taking of our everyday lives (Haraway, 1991). In the past work, I have explored how it is necessary to consider how considerations of the *cyborg* enhance our humanity and relationships with other humans and more-than-human companions by facilitating connectivity and embodiment that is queered and playful and move us to decenter the anthropocene (Lizárraga & Cortez, 2020). Indeed, in today's age our bodies can be enhanced, augmented, or in other ways configured by the use of digital media technologies (Lupton, 2012) in order to take action in the world in unprecedented ways. In the following, I nuance this perspective by making the case that *cyborg* practices go beyond the mediation of everyday convenience and can be prophetic, sociopolitical, and speculative. That is to say that in a world where inequality and violence continue to permeate, cyborgs can and do reconfigure themselves in speculative ways to imagine and organize toward a world free of dispossession, displacement, and injustice (e.g., Lizárraga & Cortez, 2019).

## **The cyborg and shifting subject/object relations**

The *cyborg* challenges normative conceptions of the relationship between subjects (individuals) and objects (the tools external to our human bodies). Haraway (2006) offers two descriptions of the cyborg in her influential work: one that is material, part machine and part human, and that enhances biological capabilities; and the second more metaphorical, which suggests a connectivity across humanity that pushes against the boundaries of gender and race, and fosters a collective consciousness. In the age of proliferated digital connectivity, artificial intelligence, and machine learning, the everyday cyborg spans both the material/mechanical and the metaphorical, moving us to consider how our collective and individual consciousness and humanity begins to transcend into blended virtual/actual (“phygital”) meta-verses (Van der Merwe, 2021).

As a learning scientist in the cultural historical tradition (Cole, 1998), I am aligned with conceptions of tools as malleable and constitutive with the needs of a given situated activity (Pea & Cole, 2019). Peers in information and media studies further underscore the necessity of centering the socio-technical; the relationship between our needs and desires as social beings and how we use technologies (Baxter & Sommerville, 2011; Scott & Nichols, 2017). Building on the sociopolitical impetus of the cyborg, as articulated by Haraway, I aim to operationalize how one sees the in-the-moment cyborg reconfigurations that index moves toward transforming social conditions, specifically when speculative fabulation mediates the practices of the historical actor (Gutiérrez et al., 2019).

## **Speculative fabulation**

The empirical work presented here explores the cyborg, the socio-technical, the socio-political, and the transformative. In this regard, I leverage the affordances presented by tech and media studies alongside how the learning sciences orient us toward identifying and codifying consequential learning (Hall & Jurow, 2015). I take heed of the theme of this special issue to propose that explorations of the *cyborg* facilitate an understanding of expansive and consequential learning that involves the crafting of speculative futures; the creation of ideational and material artifacts/tools that mediate narratives of new possible social realities that are equitable and just.

I derive my use of *speculative fabulation* from the writings and musings of Donna Haraway. In Haraway’s (2014) essay discussing the art of sculptor Patricia Piccini, she describes how the worlds that the artist creates “require curiosity, emotional engagement, and investigation, and they do not yield to clean judgments or bottom lines—especially not about what is living or nonliving, organic or technological, promising or threatening” (p. 242).

Through this artistic example, Haraway describes fabulation as fantastic story-telling or fable-making, which queers our conceptions of the technocultural, in the moment and within the physical institutional space of a museum (p. 248). In the design-based study described here, I further appropriate the *fab* in fabulation to underscore two key features in the fable-making process: *fab*-rication and *fab*-ulous futures. The former relates to my work's centering of digital fabrication as a tool and process for story-telling, and the latter relates to a concerted effort for these narratives to imagine a "not-yet-here" that goes beyond the heteronormative and patriarchal status quo" (Muñoz, 2009). Thus, my definition of *fabulation* aligns with notions of the cyborg: the queering of the normative and bounded biological body in service of telling new speculative stories of ourselves as individuals and collectives. The enterprise of the speculative fabulating cyborg "[propos-es] not another frontier but, rather, something more akin to a decolonizing ethic" (Haraway, 2014, p. 243). This decolonial fabrication of fabulous futurity aligns with the ethos and telos of the historical actor.

### ***The everyday cyborg as historical actor***

*A theory of learning.* I operationalize the practices of the everyday cyborg through the agency of the *historical actor*. In our writing about the Historical Actor (Gutiérrez et al., 2019), we outlined a set of *indicia* for identifying the practices of how people enact agency with the use of digital tools. These *indicia* are as follows: 1) A double-bind is felt as a given tool is not deemed adequate to solve a problem; 2) A breach of the status quo or social order occurs where normative participation, practices, and commonly held beliefs in activity are transformed; 3) cycles of experimentation emerge as tools are transformed or new tools are created in order to resolve a given dilemma; and 4) the goal of activity is expanded in ways that feel more meaningful to learners. In this past work, we present these *indicia* not as linear steps that are taken in learning activity but as key pivotal moves made by individuals and collectives to enact agency and expertise in their everyday lives. Within the context of the work presented here, the historical actor *indicia* offer an analytic for seeing learning in action, the type of learning that centers agency and transformation (c.f. Engeström, 2001; Sannino, Engeström, & Lemos, 2016), specifically as the participants of my study reconfigured their *cyborg* components to address sociopolitical dilemmas.

### **Study design**

This manuscript draws from the analysis of two hybrid (online/face-to-face) teacher education courses that focused on cultural-historical approaches to teaching and learning. The sites for this study also included two after-school

digital fabrication clubs: a science fiction movie-making program and a virtual/remote making and tinkering program. Participants included 22 undergraduate novice teachers from diverse cultural, linguistic, and socio-economic backgrounds, as well as majors including cognitive science, engineering, business, and computer science. The participants also included 10 middle school (4th, 5th, and 6th grade) students from two schools that served Latinx communities.

### ***Social design based approach***

As a social design-based experiment (Gutiérrez & Jurow, 2016), this study engaged in an iterative process of leveraging participants' *everyday cyborg* practices that I describe as digitally mediated collaboration that was characterized by careful relationship building and the creation, sharing, and remixing of multimodal and syncretic artifacts/texts. The design principles from social design-based experiments (Gutiérrez, 2016) animate this work in important ways by committing to centering how we think about the past (what is called historicity) in order to use it to think about what is possible in the future. Following this approach, I also center diversity and equity in the ways that they manifest in small interactions, but also in systems and structures. Related to this, I think about how we can engage in what Cole (1983) calls re-hyphen-mediation, which is essentially about changing systems. Lastly, as in equity-driven design-based research, I centered on how interventions and changed systems can build resilience in the system to sustain themselves. The principles of the social design-based approach informed the data collection and analysis across the sites of the teacher education courses as well as the after-school fifth dimension programs.

### ***A fifth dimension design***

The two sites of speculative fabulation in this work were the *Space2Cre8 SciFi Movie-making* and *Speculative Fabulation Lab Virtual Making & Tinkering* clubs. Both of these programs were modeled after the Fifth Dimension (Cole, 2006) informal learning environments that have been documented to foster horizontal types of learning between teachers and youth and were saturated with innovative technologies. The Fifth Dimension has long stood as an innovative model for teacher education; one that ruptures the university classroom walls and sees everyday community-based sites as valuable contexts for teacher learning. In this vein, the Space2Crea8 program was based on the innovative digital storytelling clubs designed by Glynda Hull (2003) where pre-service teachers alongside youth wrote, produced, filmed, and edited films using cutting-edge media-making technologies. The Speculative Fabulation Lab, on the other hand, is a direct descendant of



Kris Gutiérrez's (2002; 2011) Las Redes and El Pueblo Magico clubs where youth and student teachers engaged in a variety of side-by-side making and tinkering activities using digital fabrication tools like a laser cutter, a 3D printer, and circuit kits. During the pandemic, when the second program was run, these making and tinkering activities occurred remotely.

The key features of the fifth dimension sites, which served as the ground-work for my research, include 1) a keen attention to how teacher learning emerges from participatory practice, research, and reflection, or what is called *mediated praxis* (Gutiérrez and Vossoughi, 2016); and 2) designed opportunities for teachers and youth to engage in transformative side-by-side learning through hands-on activities. This genealogy and design features made the sites described in this writing fertile ground for creativity-driven collaboration.

### ***Focal participants***

The following vignettes feature three participants (of the 22 undergraduate students) who were part of two studies. These focal participants were selected by virtue of the quality and consistency of what I interpreted as their speculative cyborg sociopolitical reconfigurations. The first vignette will focus on Christine<sup>1</sup> who was a senior in the teacher education course titled *The Art of Making Meaning: Educational Perspectives on Literacy and Learning in a Global World*. She self-reported as female and Mixed-race (White and Japanese). The second vignette is from another teacher education course called *Educational Psychology for Elementary Schools*. The two participants in this latter example, Joanna and Alma both identified as Female and Latina, and were both matriculated in the elementary teacher education program of a major university.

### ***Data***

The study draws from 120 hours of classroom and after-school program video data (360-degree, conventional and Zoom video conferencing) 20 hours of semi-structured interviews, 68 field notes, 20 reflection podcasts, and 400 digital artifacts produced by 22 participants. Data also included data analytics from a custom-designed digitized learning management system called FabSpace, which consisted of tabulations of participant posts and engagement with others on the network over the period of 4 months.<sup>2</sup>

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<sup>1</sup>Pseudonyms used throughout.

<sup>2</sup>Participants consented to the collection of these backend data analytics is.

## Data analysis

The multiple data sources gathered were triangulated and analyzed using three main processes. First, with the results of the automated tracking system of the learning management system (LMS), I tabulated the frequency and types of participants' postings to the digital network—including their digital artifacts, comments on contributions, and their communications with each other on the network. A second type of analysis was open-ended and focused on thematic codings (Bogdan & Biklen, 1997; Dyson & Genishi, 2005) of observational field notes and interviews. Through these analyses, I aimed to elucidate the nature of individuals' and groups' asynchronous and synchronous engagement online; their semiotic, linguistic, and social choices; intentions, needs, and aspirations; and their learning, their expertise, the expertise of their peers, and the expertise of the youth that they worked with. A third cycle of analysis aimed to identify patterns in clusters of data (Miles, Huberman, & Saldaña, 2014). These clusters and patterns are what inform the findings of this article.

Digital artifacts were analyzed using previously developed multimodal analysis techniques (Hull & Nelson, 2005), focusing on how those products conveyed meaning through different semiotic systems (such as image, sound, and language) and through combinations of multiple modes of meaning-making.

Video data was systematically analyzed using previously designed micro-interaction video analysis (Erickson, 2012). Video and audio were logged in 2-minute and 10-minute segments on a variety of metadata (e.g., tool use, main activity, and participation structures). Units of analysis for the video included, for example, virtual classroom practices (Level I) and instances of articulated speculative fabulation (Level II). Subcodes (Level III) were developed inductively during systematic coding of video recordings, interview transcripts, field notes, and video logs. Data was further reduced through analytic memos to help identify salient themes shared across all video data.

## Speculative fabulation in times of crises

In the following, I describe two examples from my work with undergraduate student teachers and Latinx and Black youth. The first example illustrates the collaborative *cyborg fabulation* in an after-school Sci-Fi movie-making program. Here, I will highlight how a pivot toward engaging in everyday dilemmas catalyzed *Cyborg Sociopolitical Technical Reconfigurations* where learners assembled ideational and material tools to craft objects of learning activity that went beyond those established by teachers and schooling. The second example focuses on the collaborations between two Latinx student teachers who engaged in *speculative fabulation* that involved organizing for

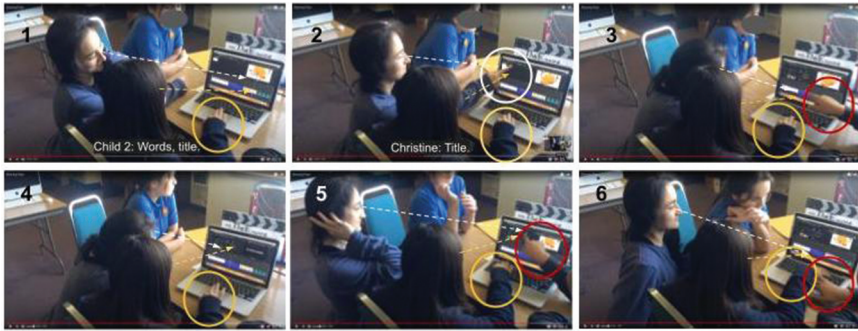
storytelling that departs from the normative practice of authoring stories for a white gaze. Across both examples, I will be using the Historical Actor *indicia* (Gutiérrez et al., 2019) to signal specific phases of transformative learning: 1) A double-bind is felt as a given tool is not deemed adequate to solve a problem; 2) A breach of the status quo or social order occurs where normative participation, practices, and commonly held beliefs in activity are transformed; 3) cycles of experimentation emerge as tools are transformed or new tools are created in order to resolve a given dilemma; and 4) the goal of activity is expanded in ways that feel more meaningful to learners.

### ***Trump gets sucked into a black hole***

In this first example, I describe the experiences of one of my student teachers named Christine as she worked with young Black and Latinx youth in an after-school digital fabrication program that focused on science fiction (sci-fi) digital film-making. Christine was part of a team of undergraduate pre-service teachers who co-designed a club that had as the primary initial goal that young people develop technical skills of using cutting edge digital filming and editing hardware and software. This program was held in an after-school space of an urban school serving Latinx and Black youth and families.

In the after-school space, Christine took her responsibility as co-designer seriously. She often grappled with how to best organize for learning and with her role in that space. Throughout the 15-week program, Christine tested different pedagogical practices sometimes, especially at the beginning, observing students at a distance while they worked on student-led activities. As a youth-driven after-school space, I noted that in the first few weeks, Christine mostly supported youth-inspired work, being cognizant to not interfere with their creative process and their independent exploration of the tech in the space, tools that included green screen technology and editing software. In this regard, she aimed to privilege the cyborg configurations of the youth with whom she worked, unencumbered by an adult's influence.

Discourse and gesture analysis (Erickson, 2012) of the activity that was video-recorded in the movie-making club showed how arrangements and dynamics between teacher and student fostered specific types of collaboration. Figure 1 illustrates side-by-side work, where children prompt much of the collaboration with their hands, indicating their extended corporeality through the computer as a mediating artifact (Pea & Cole, 2019), their cyborgness (Frame 1). Frame 2 shows how Christine, through her gestures, enacts instrumental stances (Goodwin, 2007) to orient the activity, underscoring that she is part of the collaborative process even when it is not she directly using the technology. This analysis further reveals how the (often overlapping) gestures of other youth are also important (Frames 3 and 5).



**Figure 1.** Frames from video analysis of collaborative work (Week 5).

Frame 6 further illustrates how as youth fight over the use of trackpad, *cyborg collaboration* can also emerge in the sharing of digital instruments. Indeed, it is my claim that this shared computer was a collective *cyborg reconfiguration* that fostered distributed expertise among the youth and the educator. Generally, analysis of video data in this movie-making club showed collaborative side-by-side work being done where cooperative stances that demonstrate a willingness to initiate or sustain an activity emerges.

In the analysis illustrated in [Figure 1](#), Christine and other youth guided a central youth in using the iMovie features so that the child could get a cartoon taco animated and titles inserted. Near the end of week 5, the youth were becoming comfortable with the software and hardware present in the club. The *cyborg configurations* illustrated above—the laptop as corporal extensions for all involved—facilitated a distributed co-operation. In this regard, the youth were doing the technical learning that we expected of them. Specifically, from a co-operative action perspective, the cyborg configuration shows an embodied instrumental stance whereby they positioned themselves to “perceive as clearly as possible, and in ways relevant to the activities in progress” (Goodwin, 2007, p. 61). In effect, from a historical actor perspective, the tools available proved sufficient for the current task at-hand: the individual and collective learning and use of a digital editing software.

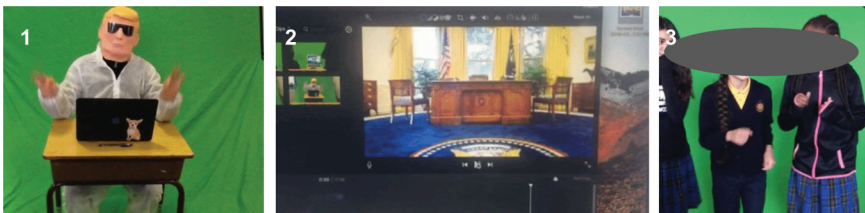
However, during the 7th week of the program, a tension—the first step of the historical acting indicia—emerged where the youth, despite having become increasingly confident in their use of the technologies in our program, were not satisfied with the direction of their films. Analysis of the video recording revealed that during week 7 of the program young people began talking about how they were feeling displaced by then president Donald Trump and that he was affecting their Latinx communities in negative ways through his propagation of anti-immigrant discourse. In these casual

conversations, the youth expressed how they did not feel like they could do anything about the stress and harm their families were feeling.

The core of the tension and dilemma was that while the after-school program was designed to leverage their everyday interests, youth initially felt that the political was not something they could engage with in our program, primarily because it was being held in the school library (within the space and architecture of a school that often limited their engagement with the political), and because there was a perceived emphasis of our program that revolved around the learning of the technical skills of movie-making. But as we continued to remind our youth that they were co-designers of a space that was touted as one that engaged with the everyday, and as we began to ask for more supply requests, our young learners asked for a latex Trump mask, which we promptly delivered during the next week (week 8) of the program.

On week 8 of the 15-week program, I observed a breach of the social order (second indicia of the Historical Actor) as youth started changing the expected dynamic and the cyborg configuration between teacher and student. As illustrated in [Figure 2](#), youth began to bring Christine into the filming and production of the film (Frames 1 and 2). What I underscore here is that as young people began to breach the status quo, they began seeing their relationship with their teacher anew and their collective cyborg configurations began to change. As young filmmakers, the youth began taking ownership of all aspects of the project and used the Trump mask to transform the teacher's role in the collaborative enterprise. I further propose here that the youth and the teacher engaged in the initial stages of the historical actor, whereas they disrupted normative participation, practices, and commonly held beliefs in activity. The Trump latex mask, as a cyborg tool, mediated this shift in embodied ways.

Christine, in her field notes, reflects on her shifting role as collaborator in the after-school program by stating “sanctioning the girls’ playfulness may have also been a factor in keeping the cast more productive” (Field Note, 4). Further, she becomes keenly aware that as the dynamic in her work with young people began to change, it became necessary for her to facilitate



**Figure 2.** Cyborg reconfigurations: breaches and cycles of experimentation.

transgressive acts or breaches in the social order. In this regard, she saw it necessary for her to be open to the youth changing the collective *cyborg sociopolitical configurations* in service of this work of intergenerational collaboration and world-making. In this sense, I see this breach as a speculative, future-oriented move with unforeseen outcomes.

In a post interview, where Christine and I co-viewed video recordings of the club, we noted that at a certain point one of the children walked up to her and took the iPad from her hand while in the middle of recording. I asked her what she thought as this young person, in a sense, took control so suddenly.

### Excerpt 1

*Post Interview with Christine.*

- (1) When she got up and was telling me how to use the iPad properly, it was functioning
- (2) more of like a way for her to show her expertise in using this tool, I mean, she has a lot
- (3) more experience using it than me.

Indeed, the shifting of expertise—mediated by a cyborg reconfiguration—that Christine describes is animated in powerful ways thereafter; they begin engaging in *speculative fabulation* or a digitally mediated crafting of a story that ruptures expected, hierarchical forms of engagement between adult and youth.

Starting at week 9, I saw a cycle of experimentation (the third phase of the historical actor framework) emerges as the young people, in collaboration with Christine, began to design, with the use of state-of-the-art film-editing technology, fantastical stories of social futures that are free of the tyranny of Donald Trump. The youth wrote and developed a short film about how Donald Trump joined forces with an invading alien robot force in order to dominate the world. The young girl protagonists initially evade Trump and the robotic army ([Figure 2](#), frame 3), and later in the film devise a plan to get the antagonists sucked into a black hole. Notably, the youth did some research on singularities and blackholes when doing so.

One could claim that this is an example where an activity is completely student-led and that, perhaps, Christine just helped advance this activity. However, I contend that had I examined the activity in the after-school filmmaking club through one that only focused on the youth learning how to use technology or learned the technical digital literacy skills, rather than that of where we center the speculative possibilities of fabrication, I would have failed to see the deep collaborative work between Christine and the young people. This collaboration is notably characterized by a fluid cyborg reconfiguration—arrangements of extensions of corporeality—in order to facilitate a playful storytelling that involved the equitable participation of

teacher and youth, alike. Specifically, this example illustrates a co-designing and co-construction of a goal of activity that went beyond the creation of a film and learning of the technical skills of filmmaking, toward the creation of an artifact that had meaning to them and had a deep socio-political critique. In this regard, *fabulation* (fabulous story-telling) required a decentering of the learning of the skills related to the use of technology and re-centering the everyday to facilitate this kind of powerful consequential learning where “[. . .] people acting within arenas of limited influence can still have profound influence over their own lives” (Juwon & Shea, 2015, p. 287).

### ***Fabulation as humanized narratives of futurity***

The following focuses on the collaboration between two student teachers as they planned for their practicum experiences with youth through our remote making and tinkering club called the *Speculative Fabulation Lab*. This club designed opportunities for our predominantly Brown and Black youth to engage in remote digital fabrication alongside student teachers in the Educational Psychology for Elementary School course. To this end, my research and teaching team assembled maker kits that were sent home to teachers and youth, which included circuit kits, and other STEAM supplies. An exciting feature of this fabulation lab was the added opportunity to print remotely to a centrally located 3D printer. The club also featured a custom-designed enclosed social network called FabSpace where youth and teachers are able to connect and share in the ways that we do in our everyday lives. This latter feature was a concerted effort to center the importance of community, recognizing that there are important relational and social aspects of spaces like the moviemaking and maker spaces that I previously described as being part of the Fifth Dimension model.

This remote fabulation work was animated by a desire for our teachers to guide youth in narrating new imagined futures, especially within the context of the COVID-19 pandemic when it was at its peak in our country. Thus, the co-developed curriculum guides (which will be illustrated shortly) that we used revolved around recognizable storytelling approaches that we see in popular media, including reality competitions, influencer communities, and animation. The vision was that this curriculum guides be flexible and dynamic so that youth were able to weave in their personal stories, hopes, and desires. To this end, we spent a considerable amount of time in our Educational Psychology class brainstorming activities and iterating these guides.

During one of these sessions, focal students Alma and Joanna began initial planning for using the various tools available in our lab (take-home circuit kits, 3D printer, etc.). The prompt given to class by me, the instructor of the

course, asked student teachers to consider how they could help young people address dilemmas that have emerged during the COVID-19 pandemic.

### Excerpt 2

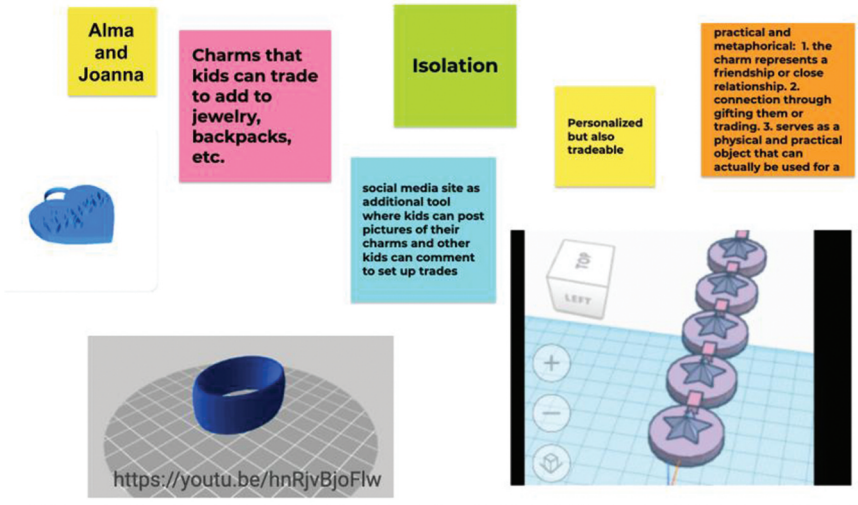
*Alma and Joanna plan.*

- (1) A: Trying to think of like something like for isolation. Like something collaborative. But
- (2) like people could send to each other or trade with each other. Do you know what I mean?
- (3) Sort of I'm thinking of like silly bands.
- (4) J: Yeah.
- (5) A: Probably like trade those with your friends and stuff like that. I would send them
- (6) through the mail. So maybe like something like that. Something that you could print.
- (7) J: Ok, so I'm like searching for bracelet right now. There's one that says like heart
- (8) bracelet. So it has like charms printed on the sides of these rings.
- (9) A: Oh. Like we could do like charm bracelets. Or like you have the bracelet and then you
- (10) just like trade the charms on the bracelets.
- (11) So the kids could even send like letters or pictures. Of their like charms to see if other
- (12) people want to trade with them. Or like our social media site [FabSpace] where people
- (13) post their charms and people can comment and be like "Oh, I want to trade with you."
- (14) Something like that.
- (15) J: Yeah.
- (16) And they can have little messages like picture I put in there [...]It can have their name or
- (17) like "BFF." You know like those heart locket. Like that kind of stuff

During this first collaborative planning session, Joanna and Alma begin with what they saw as the most pressing of dilemmas of the COVID-19 pandemic: the social isolation that many in our community faced (Excerpt 1, line 1). At the center of this discussion was fabrication; the creation of artifacts that mediate the connection between people, specifically the 3D printing of bracelets with charms that could then be shared and traded by youth (Excerpt 1, lines 7–13). **Figure 3** shows a collaborative Jamboard where Alma and Joanna documented their planning process, along with screenshots of potential 3D-printed objects. Notably, their initial plan—and imagined *cyborg reconfigurations*—incorporated almost all of the tools available in our learning ecology, including the 3D printer and our social media site FabSpace.me.

A week later, as student teachers began to make more concrete plans for their work with young people, the focus on applying concepts from our





**Figure 3.** Initial remote fabrication planning.

course in teaching practice became more pronounced. Alma and Joanna revisited their previous plan to 3D print bracelets and charms that the children with whom they work would be able to trade. However, a shift occurred as they began making concerted efforts to incorporate their recent explorations of Gloria Anzaldúa (1987) *To Tame a Wild Tongue*, and as they became more focused on bringing in academic concepts into their work in digital fabrication. Excerpt 3 shows a part of their small group planning session.

**Excerpt 3.**

*Alma and Joanna Follow-up Plan (Class Meeting 3 Recording)*

- (1) J: Yeah I think centering their identities in all we're doing. We like are making all kinds
- (2) of stuff. But I was thinking about in particular those paper things that in like Mexican
- (3) culture we make for Day of the Dead and like students could maybe make something like
- (4) that. For, uhm, incorporating their culture. And using that as a tool.
- (5) And then, even if you have kids in that class you aren't from that culture it's like a
- (6) learning experience for them.
- (7) Maybe even using them in like you know a reading kinda lesson. Like students could
- (8) create stories of their own. They can like make one or two to tell a story and they would
- (9) have to like share that story with the class. Narrate it somehow. And that way would be

- (10) working on like reading and literacy and that stuff. Or even have students like guess what
- (11) the story is, you know.
- (12) A: Or like read a story to them. Uhm. And then give them a prompt that like goes along
- (13) with the story of the book. And then like okay make a story of your own life, or
- (14) something like that.

What is significant about this interaction, from a Historical Actor perspective, is how a dilemma emerges for the student teachers, who are both of Latinx heritage, as they recognize some of the potential problematics of reductively leveraging linguistic and cultural diversity in their activity planning. Namely, they were concerned about the potential tokenizing of students of color's everyday experiences, without seeing the child as a whole and considering the deep ties between identity and cultural practices (see Gutiérrez & Rogoff, 2003). Alma and Joanna thus center on the potential stories, the *fabulations*, that youth of color may generate through mediated activity, rather than those imposed by them as teachers. Figure 4 illustrates how their maker activity, which revolved around a *papel picado* (Mexican cut paper crafts), has the central purpose of storytelling while blending mathematical thinking.

I posit here that another imagined cyborg reconfiguration occurred for Alma and Joanna as they sought to be humanizing in their pedagogy. Specifically, they momentarily jettison the 3D printer and other fabrication tools as extension of their corporeality for their work with youth. They

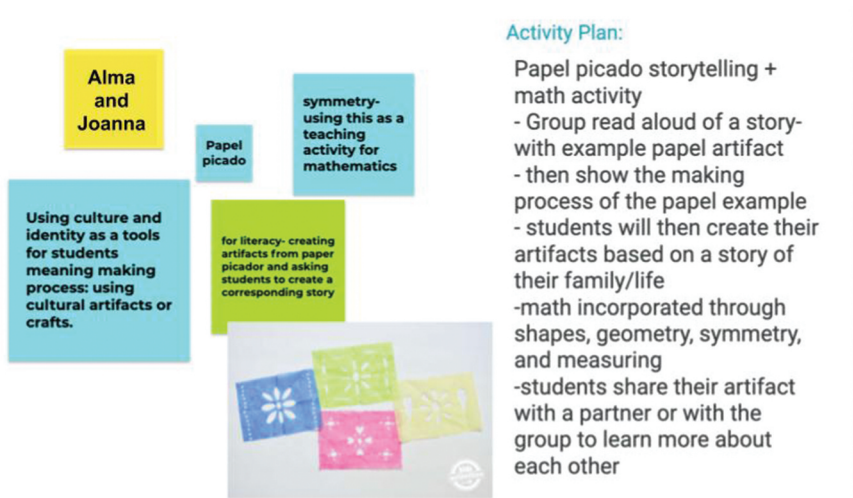


Figure 4. Follow-up planning document.

consider, instead, how an analog maker activity (the cutting of paper) might be more conducive to the learning they hope to organize for. In this regard, they tap into an embodied cultural practice that they are familiar with in order to plan for the creation of artifacts that mediate meaningful connections with youth through the use of storytelling. What takes center stage in this imagined socio-technical change is relational and collaborative over the centralizing of what may be considered exciting technology (the 3D printer and circuits). Of note, from a Historical Actor framework, is how this begins to index a planned effort to breach the social order of what is expected in the virtual making and tinkering lab.

In their third planning session, another shift occurred for Alma and Joanna, whereas they began thinking about how to incorporate ideas of cultural hybridity and Afro, Indigenous, and Xicanx futurism into their activity plans. They continued to expand their *papel picado* plan while still centering storytelling as the primary activity. In Excerpt 4, I note how they began to engage in *speculative fabulation* by thinking about how the digital could enhance the storytelling experience with Xicanx Futurism in mind.

#### Excerpt 4

*Alma and Joanna plan for speculative fabulation*

- (1) Alma: Like with the circuits, I feel like there'd be like an easy way to do like a simple
- (2) copper tape circuit and like have little LED lights. We can definitely see something like
- (3) that happening. Just to like a focal point of the papel picado, have like the led light and
- (4) that brings up more opportunity in like the making process, in like where does the LED
- (5) light go? Like what is the pattern of the copper tape to make that happen.

Alma and Joanna continued with further explorations of how sensors could also be incorporated into the papel picado and that perhaps wearable technologies could also allow youth and other audiences to engage with the papel picado in engaging ways. In these ways, they began imagining how a cultural practice that is meaningful to them and the youth with whom they work, as Latinxs, could be re-imagined as a sophisticated technology; a *cyborg socio-political reconfiguration*. Further, they advance that while papel picado may be upgraded, it would still serve to mediate the authored narratives of young people.

This second example illustrates a decolonizing approach to the making and tinkering processes, and the stories that can and should be told through this practice (Vossoughi et al., 2016). Alma and Joanna's sudden, yet temporary, pivot away from centering the technologies of the Speculative Fabulation Lab signals a socio-political move that mediated a different

understanding of what is meaningful and consequential learning for their youth. It is important to note that the pair did center the affective early on in their planning sessions but that a significant shift occurred in terms of what they felt were the appropriate mediating artifacts once they started focusing on the everyday lives of youth of color. This, from a Historical Actor perspective, signals efforts to engage in cycles of experimentation, toward an expanded and future-oriented (way into the future) object of learning activity.

The preplanning in our class was complemented with consistent and constant revisiting of the literature, specifically as our teachers engaged in their documentation of practice and reflection of said practice. In the following excerpt from Joanna's second field note, she writes about how her hesitation to directly broach the topic of culture and race caused her to connect to a reading from earlier in the semester:

#### Excerpt 5

##### *Alma's Field Note 2*

This situation allowed me to connect with a reading earlier this semester [. . .] "Socialization efforts (or what we think of as education—formal or informal): should be aimed at holistic development and not compartmentalized; should productively incorporate children into a broader community, and should include moral development" (Lee et al., 2020, p. 24).

As mentors to these students, it's our responsibility to foster learning and aid their development as people within their community. Considering [their school] is a bilingual school, I think developing [students'] understanding of culture and equity by building off their experiences will be greatly beneficial for their developing as learners."

Of note here, is that the course readings, now in conjunction with her reflections of practice, opened up opportunities for her to think of centering other priorities in her teaching. In this case, the whole child, and the way that the child sees themselves presently in a broader community, and I would claim how they see themselves in said community in the future. Further, I see here how Joanna privileged both the process of learning and literacy development and the product of these. That is to say, the initial focus on producing artifacts, papel picado as mediators of content knowledge are put to the wayside, instead thinking about the importance of the relational, and community, indeed the sociopolitical.

Finally, I take a look at an interaction between Joanna and a youth that occurred during the last session of our 15-week remote digital fabrication lab. In [Figure 5](#), we see a young Latina refine the construction of a robot claw that was part of a maker kit that we mailed her. A transcript of the interaction is shown in [Excerpt 6](#).

**Excerpt 6.***Joanna's Final Session with Youth*

- (1) Joanna: Did that work at all? It's getting bigger
- (2) Youth: Whoa yeah I think you got it.
- (3) Joanna: I think maybe uhm the slider you can move it with your hand too and not leave 4it on automatic. I think you can do it by hand so it might open wider that way i'm not too 5sure though.
- (4) Youth: Okay
- (5) Joanna: How do you feel? We did it!
- (6) Youth: I feel happy; ingenious.
- (7) Joanna: You are a genius! You are a genius I'm very happy for you.
- (8) Youth: Oh you want to see what I do?
- (9) Joanna: Oh is that your homework?
- (10) Youth: Yes.
- (11) Joanna: Is that math?
- (12) Youth: Yes, I'm going in fifth grade.

My analysis of this interaction shows intentionality in how Joanna guides the youth in finalizing a joint activity, asking questions rather than dictating as the young person in effect is creating a literal cyborg component in the form of a robot claw (lines 1–6). There is a powerful development of technical expertise happening here, indeed. But of importance here is the collective sense of accomplishment, and the highlighting of a child's genius, that emerged as this joint cyborg reconfiguration occurred (lines 7–9). This highlighting of genius is a significant moment for our teacher Joanna's sense-making of what is important in her practice. Specifically, this teacher becomes primarily concerned with how the youth views herself currently and in the future—a *speculative fabulation*. And while the new world-making is



**Figure 5.** Joanna helps her student build a robot claw.

not happening in the moment here, we do see a kernel of imagining a new future happening.

## Discussion

An engagement with the socio-political mediated important shifts for the student teachers in this study, specifically in regard to how they viewed and used technologies for their *cyborg configurations*. In both examples, an initial focus on the technical skills of digital fabrication—what can constitute a tech-oriented cyborgness—was met with dissatisfaction, especially as teachers attempted to earnestly leverage everyday cultural practices of youth and non-dominant communities. In this regard, the initial *cyborg* configurations were transformed in order for these extensions of corporeality to serve more expansive purposes; those that narrated new possible futures that were dignity-affirming and advanced new civic engagement.

Mirra and Garcia (2020) describe speculative civic literacies as those that involve the development of “expansive, creative forms of meaning making and communication aimed at radically reorienting the nature and purpose of shared democratic life toward equity, empathy, and justice” (p. 297). Christine and the youth with whom she worked indeed transformed the arrangements of meaning-making (their *cyborg* configurations) in order to work side-by-side in their fantastical re-imagining of a world under the oppressive thumb of former President Trump. Similarly, Alma and Joanna’s recentering of youth-authored story-telling, a re-orienting of the centrality of the tools of digital fabrication, illustrated a concerted effort to foster equity and empathy during a time of global crisis.

In examining the digital fabrication present in this work, Vossoughi et al. (2016) further compel us to challenge culturally normative notions behind the popularity of the maker movement by being “mindful of the heterogeneity within and across these groups while identifying the dangers present in the uncritical adoption of branded versions of making, particularly with regard to their implications for educational equity” (p. 210). In this regard, my participants’ engagement with socio-political issues and everyday dilemmas ruptured notions of innovation and academic learning that can emerge through digital fabrication. Indeed, by reconceptualizing our learning ecology as one of the *fabulation*, the everyday hopes and desires of our communities of color served as impetus for creativity and ingenuity. For Christine and Black and Brown youth, cutting edge editing software allowed them to create a tangible rendition of a future free of a tyrant. For Alma and Joanna, this meant deprivelizing what could constitute one of the most exciting tools available in our remote fabrication lab and centering dignity, joy, and genius of youth today and tomorrow.

While I have focused on the practices and shifts in with three student teachers, it is important to highlight the shifts that occurred in the broader ecology by virtue of the iterative design of this project. For example, during a whole-class share-out during the aforementioned second planning session, Alma and Joanna's focus on the story-telling aspect of fabrication was taken up by their peers. Jason (also a participant in this research, self-identified as white and male) expressed:

I love what you guys were just saying through the story-telling. That is honestly a great idea. Really cool. We were treating I guess a little more academic in terms of vocabulary.

Jason went on to describe how the planning session with his small group involved scaffolding young people of color toward the more desired academic language by using the youth's "home language." He recognized during the full-class discussion that a narrative approach helped him overcome what he felt was a dilemma in trying to authentically leverage the cultural practices of the youth with whom they work. He further stated how the maker kits would help mediate mutual intelligibility in collaborations with youth with diverse cultural and linguistic practices because of how "you don't have to use words as much because it's embodied" (Week 7, Hour 00:16:20). In this regard, the implications for the learning of those from dominant populations who work with non-dominant communities are also clear.

## Conclusion and implications

This work illustrates how *cyborg as historical actor* framework, which privileges the social aspect of learning through a cyclical yet iterative model of problem posing, breaching of social orders, experimenting, and expanding the purposes of an activity, can help us reimagine how we design programs around the learning of tech and computer science; in this case, the learning of how to use hardware and software of filmmaking and digital fabrication. Specifically, as cyborgs teachers and youth reconfigured their socio-technical assemblages to facilitate the learning that is important or consequential for them.

This conception of the *everyday cyborg* facilitates *speculative fabulation*, that is "about worlding 'naturaltechnical' worlds [. . .], worlds needy for care and response" (Haraway, 2014, p. 242). The work presented here builds on previous projects that have sought to examine how *everyday* cultural practices (Gutiérrez & Rogoff, 2003) can mediate meaningful and consequential learning that is, at its core, socio-political, and transformative for communities of color (Gutiérrez et al., 2019). I argued that designing learning environments for the *everyday cyborg*, in this case novice teachers and middle schoolers in Black and Latinx-serving after-school programs, fosters

an engagement with everyday dilemmas in ways that serve as catalysts for further learning (Engeström, 2006) and the new world-making or *speculative fabulation* (Haraway, 2014).

Across both vignettes, I have shown how co-designed side-by-side learning ecologies result in shifting priorities for teachers, where the object of learning centers on the collaborative process in addition to the technical aspects of digital fabrication. In the vignettes, we see relationships privileged and the enactment of theory and reflection in powerful ways. In both instances, new world-making—fabulation—occurs. Christine engaged in fabulation alongside youth, in the moment. Joanna and Alma used their collaborations with youth to begin planning for her future teaching practice.

As everyday cyborgs who engage in *speculative fabulation*, we must continue to reconfigure our parts to solve everyday dilemmas, and to author and tell new stories about ourselves that are liberatory and just. In my opening story, I underscored how our cyborgness does not solely reside in our enhancement with technologies, but a reconfiguration of extensions to our corporeality in order to author a story about ourselves (a fabulation) visible through our care, our craft, and artistry, an agentic and sociopolitical move. Intentional design can mediate a fabulation of a present and future in spaces and places that were not made for communities of color, or seek to invisibilize these communities. To fabulate is to create a new world with hope, possibility, and dignity.

## Disclosure statement

No potential conflict of interest was reported by the author(s).

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