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Hong-An Wu

University of Texas at Dallas, Richardson, United States of America

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THE LABOR OF CARING FOR TECHNOLOGICAL TROUBLES IN EDUCATION

Hong-An Wu

University of Texas at Dallas, Richardson, United States of America

Abstract: *In this article, I explore the lines of inquiry opened by moments of technological troubles encountered during teaching and learning. Instead of assuming that these moments are obstacles to be overcome, I delve into what these moments imply for educational research on teaching and learning through a posthuman approach. Troubling the figure of the posthuman with regard to the ethos that technologies are revolutionizing education, I argue that we need to pay attention to the labor of caring for technologies, particularly during moments of technological troubles, in order to address the uneven proximity to humanness, subjecthood, and emerging technologies based on intersectional embodiments. With this understanding, I propose a posthumanist methodological approach centered on tracing the care-giving labor for emerging technologies performed by teachers along with students during moments of technological troubles as a potential direction for educational research grappling with the posthuman. Furthermore, I provide an initial foray into using this methodology to count, recount, and account for the labor of caring for emerging technologies during moments of technological troubles across my teaching experiences at a Fab Lab and public library. In so doing, I suggest that we need to further trace the labor of caring for technological troubles to better understand our socio-material co-configurations with our nonhuman companions toward more sustainable and equitable futures in education.*

Keywords*: care; emerging technologies; technological troubles; pedagogy*

Introduction

"Hold on, you're muted..." "Wait, can you see my screen?" "I think it's working, as I was saying…"

These utterances were repeated throughout the last three years by teachers and students across the globe as we scrambled to connect via various digital platforms under a raging pandemic to perform our work. They point toward not only a recalibration of technological proficiency across historic, political, and material hierarchies of technological developments but also a normalized temporal order that systematically directs time, resources, and capital during teaching and learning toward maintaining the new frontier of hierarchized technological development (Freishtat & Sandlin, 2010; Sharma, 2020). Most importantly, these utterances mark the significant moments of technological troubles that demand the labor of caring for emerging technologies from teachers and students toward their nonhuman companions co-constituting their practices.

In this article, I explore the lines of inquiry opened by these moments of technological troubles encountered during teaching and learning. Instead of assuming that these moments are obstacles to overcome, I delve into what these moments imply for educational research through a posthuman approach. To do so, I begin with a section situating the figure of the posthuman, in and beyond educational research, for the purpose of this article. This section draws out the tensions of the posthuman regarding the ethos that technologies are revolutionizing education. Against these tensions, I argue that we need to pay attention to the labor of caring for technologies in order to address the uneven proximity to humanness, subjecthood, and emerging technologies based on race, class, gender, dis/ability, ethnicity, nationality, and more (Wynter, 2003; Liao, 2008; Chan, 2014; McKittrick, 2015; Hamraie, 2017). In the following section, I unpack the tangled layers involved with the labor of caring for technologies in education through the axes of care, technologies, labor, and temporality. In so doing, I propose a posthumanist methodological approach centered on the *care-giving* labor for *emerging technologies* performed by *teachers along with students* during *moments of technological troubles* within bounded instructional periods. Drawing on my pedagogical encounters with moments of technological troubles as a teacher at a Fab Lab and a public library that predate the pandemic, I provide an initial foray into *using* this methodology to count, recount, and account for the labor of caring for emerging technologies during moments of technological troubles.

Situating a posthuman approach in educational research

I begin by describing how I situate this article in relation to the posthuman, as theorized and represented by discourses both within and beyond the context of educational research. As Bessie Dernikos, Daniel Ferguson, and Marjorie Siegel (2020) emphasized, there's "no one theory of posthumanism" (p. 436), and it is not within the scope of this article to elaborate on the various strands. However, across the various interpretations of posthumanism vis-à-vis educational research, there are three recurring threads that I want to foreground.

First, the figure of the posthuman troubles how 'the human' has been conceptualized, centered, and practiced in relation to education, writ-large, under the liberal humanist tradition in the west. As Snaza et al. (2014) described, 'the human' is an invention of "a social and political category, one that has accrued a wide-range of interconnected meanings, beginning in ancient Greek philosophy and undergoing important transformations in modernity" (p. 42). Under this tradition, the human and the broader field of humanity are tied to a logic of progress and achievement based on an individual self-determined will and agency, especially through a 'civilizing' process called education. As Snaza et al. (2014) further emphasized, "Enlightenment thinkers like Rousseau and Kant returned to Plato to insist that the human is not simply a being that is, but something that some beings can become through education" (p. 42). However, this original invention, 'the human,' is being challenged by another invention in the west, 'the posthuman,' which attempts to account for the dispersed wills and agency of both human and nonhumans in relation to emerging technological mediations during the process of 'civilization.' Drawing on C. B. Macphereson to position the invention of the posthuman under the cybernetic tradition, N. Katherine Hayles posited that the liberal humanist subject as an autonomous individual possessing complete "freedom from the wills of others" and "owing nothing to society" (Macpherson, 1962, as cited in Hayles, 1999, p. 3) is "undercut in the posthuman, for the posthuman's collective heterogeneous quality implies a distributed cognition located in disparate parts that may be in

only tenuous communication with one another" (Hayles, 1999, p. 3-4). In practice as taken up in educational research, this translates to decentering the human and its presumed agency to ask "how to account for how materials participate in school practices and for what is performed through this participation" (Sørensen, 2009, p. 3).

Second, the figure of the posthuman is often used to advocate for recognizing the agency of things, technologies, animals, and other beings that were previously denied a subject position, especially in education. As Estrid Sørensen (2009) articulated, "educational research lacks a methodology for the study of learning that does not begin with humans, their aims, and their interests" (p. 3). By decentering the human and uprooting human-centrism, the posthuman promises to 'flatten' the hierarchy between human and nonhuman beings for rethinking everything about education. This is not to say that 'the human' no longer matters, and this flattening of human and nonhuman hierarchy is not without its own problems of erasing uneven power relations between humans. Nonetheless, the posthuman as a figure is leveraged to "place the human not above materials (as the creator or user) but among materials" (p. 2) in educational practice. By "acknowledging the 'agency' of knowing in nonhuman subjects," Nathan Snaza & John Weaver (2015) asked: "What sorts of research could emerge that might include nonhumans as subjects?" (p. 5). Beyond turning toward nonhumans as starting points for educational research, Kylie Peppler, Jennifer Rowsell, and Anna Keune (2020) further argued that "posthumanist theory helps researchers to pivot away from a sole focus on learning toward a broader conception of how we experience the world as humans intra-acting with matter" (p. 1241). In contrast to using the word 'interaction' that presumes "there are separate individual agencies that precede their interaction" (Barad, 2007, p. 33), they built on Karen Barad's theorization of intra-action as "constraining but not determining" (2007, p. 177) to argue for an openness toward researching teaching and learning. By withholding ingrained assumptions about what learning should look like, they call for researchers to focus on the present and what is happening in practice, which hopefully leads us toward more generative questioning of what is possible.

Third, the figure of the posthuman often emerges in discussions concerning technology in education, especially the digital kind, and about humans' relation to it. In contextualizing the posthuman and its discourses, many educational researchers and scholars, myself included, trace this figure to N. Katherine Hayles' key text, *How We Became Posthuman* (1999), which troubles how human subjectivity was reconfigured into a posthuman formation under the cybernetic tradition in light of various computer-mediated technologies. Given "posthumanism—or, rather, the posthuman—is probably most familiar to educational scholars from studies of the intersection of the human and various kinds of machines, computers, and technologies" (Snaza et al., 2014, p. 43), the focus on various emerging technologies' interventions and contributions to learning and teaching becomes especially relevant when connecting theorizations on the posthuman to educational discourses. At the same time, with how "theories of posthumanity are so closely associated with theorizations of cyberspace," as Alexander Weheliye (2002) articulated, it may be no surprise that "computer-mediated communication often appears to be the precondition for becoming posthuman" (p. 24), or at least as the precondition for the posthuman figure to be leveraged in the context of education.

Building on the above three threads, I am drawn to theorizations of the posthuman as creating an

opening toward "the end of a certain conception of the humanity who had the wealth, power, and leisure to conceptualize themselves as autonomous beings exercising their will through individual agency and choice" (Hayles, 1999, p. 286). More specifically, I engage with the figure of the posthuman in this article with hopes to attend to the ongoing violence enacted by "a classical liberal humanist education," whereby "the center of discussion turns on white males and erases notions of 'gender, race, and species'" (Morris, 2015, p. 43). Thinking alongside Hayles' caution that "the erasure of embodiment is a feature common to *both* the liberal humanist subject and the cybernetic posthuman" (p. 4), my concern here lies in foregrounding a posthuman that refuses the erasure of embodied experiences based on intersectional identities.

Underneath the technoliberal posthuman

While the refusal of gendered erasure has been mounted by various posthumanist scholars, race and racialization have been only marginally addressed through the posthuman figure. As Alexander Weheliye (2002) poignantly described, "the posthuman frequently appears as little more than the white liberal subject in techno-informational disguise" (p. 23), precisely because "concepts of the cyborg and the posthuman, largely do not take into account race as a constitutive category in thinking about the parameters of humanity" (2008, p. 321). Without accounting for and following through intersectional identity categories, and particularly race, as "sociopolitical processes that discipline humanity into full humans, not-quite-humans, and nonhumans" (Weheliye, 2014, p. 4), it is inevitable that "the figuration of 'humanity' following the post- of the post-human brings forward a historically universalizing category that writes over an ongoing differential achievement of the status of 'the human'" (Atanasoski & Vora, 2015, p. 8). In other words, the figure of the posthuman needs to be engaged with caution to avoid repeating the liberal logic of progress that produces yet another grand, universal, and desirable frontier narrative of humanization to be reached unevenly across bodies in the context of education.

To refuse the framing of the posthuman as an advancement from 'the human' under a linear temporality of progress, I turn toward considering technology, as one category of nonhumans being foregrounded as subjects to be taken up in the context of educational research mentioned above, in the composition of the figure of the posthuman. Building upon Judy Wajcam's (1991) and Neda Atanasoski and Kalindi Vora's (2019) analysis of technology, I approach technology as "a form of knowledge" (Wajcam, 1991, p. 14) manifesting power through an arrangement of order that "reiterates use, value, and productivity as mechanisms of hierarchical differentiation and exploitation within racial capitalism" (Atanasoski & Vora, 2019, p. 15). I focus on technology here because technological changes have often been cast as the protagonist in the liberal humanist play to prop up the progress narrative (Slack & Wise, 2007). At the same time, technological changes have often been understood as the precondition for the figure of the posthuman to emerge. From *Second Life* to MOOCs to XO laptops, demands for educators and their students to 'catch up and keep up with the times' under the paradigm of STEAM is ever proliferating. These demands to become in sync with new and emerging technologies for, supposedly, better educational outcomes mirror the logics of age-old European colonialism and present-day western imperialism that utilize "discourses of technological innovation, progress, and civilization" (Atanasoski & Vora, 2019, p. 16) to differentiate while rehabilitating racialized, sexed, gendered, classed, and disabled others.

To better contextualize the ways in which emerging technologies have been mobilized and enclosed into the linear temporality of societal progress under liberal humanism, I turn to Neda Atanasoski and Kalindi Vora's key text *Surrogate Humanity* (2019) for help. In this text, Atanasoski and Vora engaged in a series of case studies of emerging technologies that promise to revolutionize and remove mundane and tedious labor from society so that humanity can be 'freed' to do more interesting creative work. Instead of removing this historically gendered and racialized labor altogether as promised, however, they demonstrated that these technologies reinscribe and further conceal "conditions of racial subjugation and imperial expropriation" (p. 28) that undergird existing labor relations. They theorized this process as "technoliberalism," which they used to mean "the ideology that technology advances human freedom and postracial futurity by asserting a postlabor world in which racial difference, along with all human social difference, is transcended" (p. 28). Central to the inner workings of technoliberalism "is its production of the surrogate human effect--- that is, a racial and gendered relation emerging at the interstices of new technologies and the reconfigurings of US geopolitical dominance" (p. 28). In other words, emerging technologies do not replace labor but obfuscate it in such a way that makes the technologies themselves appear "enchanted" (p. 17), intelligent, and self-sustaining. At the same time, emerging technologies do not remove racial and gender hierarchies insofar as they reinscribe and reroute these hierarchies through arrangements of order generated by the material manifestations of things we call new technology.

To engage with the figure of the posthuman without the trappings of technoliberalism, then, requires us to foreground labor, which always entails racial, gender, and class relations, that makes the category of both technology and 'the human' possible in the first place. It also requires us to recognize that technologies and humans have never been separate self-sustaining entities. Technologies "do not work or fail in and of themselves" (Mol, Moser, & Pols, 2010, p. 14), and they certainly do not *only* depend upon the innovation labor at the research and development labs for which they were prototyped. Instead, technology, alongside the arrangements of order it produces, is made possible only because of the ongoing labor that maintains, repairs, and adapts it to specific locales and situations. Chairs and tables work for teaching and learning in classrooms because of the service crews laboring away to keep them clean. The Internet worked for learning remotely at homes because of the IT professionals laboring away to provide customer service. New technologies work for education because of the teachers laboring away to become familiarized with these technologies during their off time. In other words, technologies "depend on care work" (p. 14) to work.

As such, to refuse the framing of the posthuman as an advancement from 'the human' under a linear temporality of progress, we need to recognize that the posthuman is not a brand-new formation of socio-material relations as the result of humans laboring for, with, through, under, and against *only* emerging computerized, 'intelligent,' and 'smart' technologies, encoded with and demonstrating distributed cognitive capacities in intelligent ways. Instead, the posthuman is a way for us to name the already existing and yet previously-unnamed formations of socio-material relations that are constantly refiguring. Most importantly, the posthuman is a language that positions us to recognize the ways in which humans *have always been* laboring for, with, through, under, and against technologies of various kind, from old to new, from things to concepts, from colonialism to STEAM, to form what have been understood as 'the human' under the liberal humanist tradition. In other words, the posthuman, here in this article, refers not to the condition of humanity after cybernetics as a particular historical moment

but instead to the condition of humanity that has always existed in practice alongside the liberal humanist tradition as its underbelly. As Weheliye (2008) asks, "what different modalities of the human come to light if we do not take the liberal humanist figure of 'man' as the master-subject but focus on how humanity has been imagined and lived by those subjects excluded from this domain" (p. 321)? As my attempt to follow this line of inquiry in the context of education, I foreground a posthumanist approach that examines the often taken for granted and yet crucial labor that makes encountering technologies in education possible in the first place: the labor of caring for technologies.

Laboring to care for technologies in education

In the previous section, I wove together existing theorizations, concerns, and applications with the posthuman to situate an approach with it that accounts for the uneven proximity to humanness, subjecthood, and emerging technologies. Such an accounting led me to foreground the labor of caring for technologies as critical to the study of teaching and learning through a posthuman approach in educational research. But how do we begin to examine the labor of caring for technologies in education? Or, more precisely, how do we navigate the abundant lines of inquiries opened in this direction and differentiate which paths to pursue (and toward what ends)? By unpacking the layers of care, technologies, labor, and temporality below, I make a case for following the *care-giving* labor for *emerging technologies* performed by *teachers alongside students* during *moments of technological troubles*.

Care

First, let's attend to care. Drawing from Berenice Fisher and Joan Tronto's (1990) well known definition, I approach care as "a species activity that includes everything that we do to maintain, continue, and repair our 'world' so that we can live in it as well as possible" (p. 40). We, the writers and readers of this academic journal, care about technologies of digital culture in relation to practices of teaching and learning, which is why I presume we read and write here. School administrators and educational politicians take care of the bills, with sponsorships, donations, tuitions, and taxpayer money, that come with affording teachers and students to encounter technologies through education. Educational technology corporations can innovate functions and features of their product because their product receives care via the attention and payment given to sustain its experimentation, adoption, and circulation.

However, to foreground the labor of caring for technologies that manifests relations of ongoing subjugation, I argue that we need to focus on the practice of *care-giving*, as a specific form of care. In *Moral Boundaries* (1993), Joan Tronto defined "care-giving" as the physical work involved with "the direct meeting of needs for care" (p. 107). Juxtaposed against "caring about" (p. 106) as a general disposition and "taking care of" (p. 106) as the act of assuming responsibility, Tronto distinguished care-giving as the ongoing practice that "almost always requires that care-givers come in contact with the objects of care" (p. 107). This differentiation is particularly useful as it draws attention to questions of authority, responsibility, and expertise. Who can afford a dedicated IT staff team to support, maintain, repair, and update the laptops? Whose responsibility is it make sure the laptops are charged overnight so they can

be used the next day? Who can troubleshoot when the laptop won't turn on? As proximity to emerging technologies are also metrics that racialize, class, and gender bodies, focusing on the practice of care-giving amongst the constellation of labor involved with caring for technologies in education provides an avenue to recognize the intersectional embodiments of the posthuman.

Technologies

Second, let's attend to technologies. Just as there are multiple forms of care, there are endless technologies in relation to education that can be considered. Examples include, but not limited to: the filing cabinet as a technology that materializes a demand for efficiency under capitalism (Robertson, 2021); modern scientific management as a technology that traverses from plantations to factories to classrooms (Casey, Lozenski, & McManimon, 2013); or the SAT as a technology that elides and reinscribes systemic inequalities under an illusion of meritocracy (Coleman, 2011). By attending to how these technologies (are made to) work, we can further trace the uneven power relations that are made and made possible through technologies' mediation. Within the large constellation of technologies in education, I am focusing on this nebulous category named *emerging technologies* in the context of this paper. In existing literature, educational researchers have made a distinction between the things that is new and the practices that emerge as the result of these new mediations, using the term "emerging technologies" (Veletsianos, 2016, p. 4) to describe the former, and "emerging practices" (p. 4) to describe the latter. However, departing from such a distinction, I am intentionally using the term *emerging technologies* to describe both the things that are introduced as mediation for pedagogical encounters and the pedagogical practices that is disrupted, revised, and remade in the face of these things.

In other words, I use *emerging technologies* to focus on the conflicts, contradictions, and connections emerging with teaching and learning through the inclusion of both old and new, familiar and unfamiliar, things in *practice*. Because, as Jennifer Daryl Slack and J. Macgregor Wise (2007) made clear, technologies are more than their physical manifestations, and to approach technologies only in terms of their physicality prevents us from recognizing the "ongoing energies, activities, relations, interpretations, and investments within which these things appear, take flight, and have effects" (p. 97). Furthermore, to use the term 'technology' to describe only the objects risks echoing technoliberalism's ethos, which erases the amount of human labor that go into sustaining such an object to perform its supposed predesigned and encoded function. At the same time, drawing from Etienne Wenger's (1998) approach to learning as always situated in communities of practices, technologies only matter for teaching and learning insofar as they are realized in practice; they matter when they become part of our practice, which refers to a "doing in a historical and social context that gives structure and meaning to what we do" (p. 47). And yet, old practices do not just disappear, and new practices do not just appear in the face of new objects for mediation. Instead, as Jen Ross and Amy Collier (2016) argued, focusing on the "mess" that characterizes emerging technological practices allows us to "cast a new light on issues of power, responsibility, sustainability, reach, and contact" (p. 18). As such, by collapsing the distinction between the things, and the practices along with the things, I focus on emerging technologies to draw attention to the ongoing care-giving labor that sustains such technologies for encountering in education.

Labor

Third, let's attend to labor. The labor of caring for emerging technologies in education is performed by many, including administrators, faculty, staff, students, students' caregivers, policy makers, educational technology companies, stakeholders, and more. Tracing the formation of each of these subjectivities would provide important analysis on the constitution of the posthuman in educational research. If we foreground care-giving at the site of teaching and learning, though, I would consider teachers, students (and their caregivers, especially under remote learning contexts during the pandemic), and IT professional staff as warranting extra attention as they perform the bulk of day-to-day labor to sustain emerging technologies. Because, quite simply, they are the ones that come into direct contact with the physical manifestations of emerging technologies in educational institutions. I would even argue that we can understand teachers, students (and their care-givers), and IT staff as the "invisible technicians," to use Steven Shapin's (1989, p. 554) words, of emerging technologies in education. Just as the assistants, "laborants, operators, artificers, and servants" (p. 556) of philosopher Robert Boyle provided their hands, eyes, and judgements to produce Boyle's scientific and experimental 'knowledge' without being named in 17th century Europe, today's teachers, students, and IT staff labor away in classrooms to make possible our knowledge around emerging technologies in education: what works, what doesn't, why, and what's the trouble.

However, for this article, I'm focusing my discussion on the labor of *teachers*, in particular. I focus on the teacher not because IT staff and students aren't important, but because the teacher subject and their related practices are what I have access to for unpacking. Being trained under the tradition of community-based and action research through my graduate education in art education, my research and teaching practices are intertwined. My teaching experiences in higher education and community-based settings in the U.S. as a Taiwanese woman inform my research inquiries, and simultaneously my research questions direct my teaching practices. Furthermore, I focus on the teacher because I am committed to extending the long line of investigations on the power dynamics between someone positioned as a teacher versus a student (Freire, 1970; Ellsworth, 1989; hooks, 1994; Kishimoto & Mwangi, 2009). My concern here lies precisely in the distance between the authority and expertise of care-giving for technologies that students presume teachers to possess and the improvisations of care-giving knowledge that are actually produced in practice by both teachers and students. Finally, I focus on teachers because, quite frankly, dedicated IT staff to support one's teaching is a rarity for most teachers (Rogers, 2000; Delacruz, 2004). Even with teachers that have access to dedicated IT staff for support, "those who are employed as technical support personnel may lack appropriate technical support expertise" (Rogers, 2000, p. 461). With the ways in which gender and racial disparity plays out in relation to the make-up of IT professionals and teachers, whereby "eight-in-ten U.S. public school teachers (79%) identified as non-Hispanic White during the 2017-18 school year" (Schaeffer, 2021, para. 2) and 76% of U.S. public school teachers identified as female in the same year (National Center for Education Statistics, 2022) while 77% of IT professionals identified as male and 59% identified as white (Zippia, 2022), I find foregrounding the gendered and racialized labor of teachers particularly important.

Temporality

Last but not least, we need to attend to the temporality of laboring to care for emerging technologies in education. Building on Sarah Sharma's key text *In the Meantime* (2014), temporality refers not to some

universal experiences of time but instead refers to the experienced time "particular to the labor that produces them" (p. 8). Individuals' experiences of time are "in large part structured and controlled by both the institutional arrangements they inhabit and the time of others --- other temporalities" (p. 8). From the time it takes to arrive early at schools for set up, to troubleshooting unresponsive projectors during class, to staying behind after class to update software, *when* this labor takes place matters insofar as it points us to *where* care is needed and where to examine the maintenance of uneven power relations. And yet, some of this labor is accounted for in a 'plan', whereas some is not. As Snaza and Weaver (2015) argued, planning, the desire to foreclose future possibilities based on past experiences, has been central to a liberal humanist education: "Those who are already 'human' will control the educations of the young so that they too become 'human'" (p. 4). Instead, they articulated that "the posthumanist challenge is to give up on planning." Building on their argument, I differentiate between moments of normalized routine maintenance and moments of unexpected repair for technological troubles, especially under the temporality of a bounded instructional period. While in practice these two moments often coincide, I make this distinction to make explicit the care-giving labor that have been absorbed, enclosed, and planned for in sustaining emerging technologies versus the care-giving labor that perpetually exceed educational habits of planning with emerging technologies.

I argue that following moments when emerging technologies interrupts, upsets, and reroutes existing temporality of teaching and learning to demand care allows us to attend to the yet reified politics undergirding the labor of caring for technologies in education. Drawing from my previous publication (Wu, 2022), these moments are made up of encountering technological breakdowns, whereby "the 'thingness' of technologies that we physically interact and interface with decay, dissolve, and decompose over space and time" (p. 8). They also consist of encountering technological failures, whereby "technologies failed to meet our expectations of being who/what we imagine them to be and performing as we assumed they would" all the while "the 'experts' of these technologies might have argued that nothing is functionally wrong with the technologies besides a user error" (p. 9). Taken together, these moments can be understood as technological troubles, whereby "breakdown and failure collapses to form a larger constellation of entangled mess and introduces conflicting troubles within existing practice that is bounded by time and space" (p. 9). What happens when *moments of technological troubles* appear during pedagogical encounters? When the labor to care has yet to be accounted for, what is made and made im/possible through such labor of care-giving in the moment in practice?

Re/ac/counting the labor of caring for emerging technologies during moments of technological troubles in pedagogical encounters

In the previous section, I unpack the ways in which we might begin to examine the labor of caring for technologies in education along the axis of care, technologies, labor, and temporality. Specifically, I argue that examining the *care-giving* labor for *emerging technologies* performed by *teachers along with students* during *moments of technological trouble* within bounded instructional periods provides methodological grounds for a posthuman approach to educational research. This posthumanist methodological approach seeks to refuse the technolibral posthuman by centering the often-neglected human labor that

goes into sustaining emerging technologies, and it provides a possible methodological direction for educational research grappling with the posthuman as both a theoretical figure and a practical concern. In this last section, I provide an initial attempt at *using* this methodology by recounting and accounting for the labor of caring for emerging technologies during moments of technological troubles in my own pedagogical encounters as a teacher. In so doing, I hope to contribute to the growing educational scholarship that reconsiders "the relationship between the human and the material world" (Peppler, Rowsell, & Keune, 2020, p. 1241).

I begin with a contextualization of the two different teaching and learning sites that I draw upon for this analysis. The first site was in a community Fab Lab[1], short for digital fabrication laboratory, on the campus of a well-resourced research-intensive university located in a U.S. Midwest city. As a graduate student enrolled in an art education program at the same university for which this Fab Lab was housed, I was hired on part-time as a 'Community Technology Education Innovator' in 2015 and began teaching various workshops/camps and consulting on educational initiatives until 2017, when I graduated. Most pertinent to this analysis are the various youth summer camps that I participated in co-teaching during the summer of 2015. From June to August of that year, we held more than 40 sets of week-long summer camps, with some weeks running more than 3 camps in parallel at the same time, with students from elementary to high school age on a wide range of topics, from integrating *Minecraft* with 3D printing to papercraft with conductive materials. As my research was on digital games, I've mostly helped staff camps related to *Minecraft*, and each camp usually consisted of around 15-18 students along with 3-4 co-teachers.

The second site was in a public library with its own dedicated Teen Space[2] located in the same city but outside of the university campus. On most weekday after-school afternoons, the Teen Space was crowded with youths from a nearby school to hang out with their peers. Because, in part, this place was the primary, if not only, location many of them accessed emerging technologies outside of school. Upon discussion with the few Teen librarians regarding the need to develop programming that supported youth's interests in emerging technologies, I began teaching a variety of STEAM-related stand-alone or multi-week workshops at the library from 2014 to 2017, sometimes as a paid artist-educator, sometimes in relation to my graduate course works, and sometimes as volunteer work. In most instances, I was the only teacher on-site, with logistic support from Teen librarians. Most pertinent to this analysis concerns

[1] As a satellite location in the larger constellation of Fab Lab network that started at the Massachusetts Institute of Technology and now spreads internationally both officially and unofficially, this Fab Lab exemplified the network's aim to provide "a place for learning and innovation" with "access to the environment, the skills, the materials and advanced technology to allow anyone anywhere to make (almost) anything" (Fab Foundation, n.d.). This Fab Lab was equipped with two computer labs, 3D printers, laser engravers, sewing and embroidery machines, and a range of other electronics and tools. With this equipment, it regularly hosted specialty workshops trainings, open hours, and youth summer camps, and the space was open to anyone, including in-service teachers, university-affiliated people, and community members.

[2] The existence of this Teen Space followed the aim of the National Teen Space Guidelines to "offer the resources and the environment that foster positive intellectual, emotional and social development of tomorrow's adults" (Young Adult Library Services Association, 2012, p. 3). This Teen Space was equipped with a small computer lab, books, CD/DVDs, and furniture for lounging.

a five-week *Minecraft* modding[3] workshop series that I taught during the spring of 2016[4], where I worked with 7 youth participants who consistently showed up every week and a few other participants who dropped in and out across weeks. The workshops were held in a multi-function room across the Teen Space with laptops, mouses, charging cables, USB sticks, extension cords, and suitcases loaned from the university for which I was enrolled, as the library's computer security measures forbade us from downloading software to run games and accessing the backend files to edit games.

'Technology never works!'

As I forayed into pedagogical practices layered with emerging technologies at these sites, I noticed myself uttering this affectively charged and temporally specific phrase in response to moments of technological troubles: 'technology never works!' Laptops refused to turn on. The extension cord wasn't long enough. The file can't be downloaded. Wait, and the computer just shut off. These encounters, either by myself or by students that then waved me down for help, initiated us down various rabbit holes as we fumbled with technologies to get them to perform in ways that we witnessed in demos and tutorial videos. Instead of performing as we imagined or expected, technologies often had other plans, leaving students confused and myself distressed to come up with last minute workarounds and anxious about the pre-defined workshop goals that were dependent upon technologies 'working' as per our expectations.

It is with distance, now, that I can say: no, technology *does* work--sometimes, if we know what to do, or we have enough time and resources to figure it out. The problem is that in those moments, which will inevitably continue to appear, technologies were demanding us to meet them halfway, if not all the way, but we were unable to do so for various reasons. We didn't have the enough RAM on our computers. We didn't have the correct password from the 'rightful' owners. We didn't have an outlet near the desk. Technology works as advertised only if our bodies, alongside our environments, *worked* to support its optimal and predetermined unfolding. If we had the proper technological literacy. If we had the prerequisite social and material infrastructure. If we had enough time. But these are big IFs. Given that I did not partake in these pedagogical encounters with the intention to explore these troublesome moments, I did not count and cannot proclaim that these encounters were more frequent at one site over the other. However, what I do have access to, through my recollection, is the differences between these sites in terms of their technological infrastructures and the pedagogical unfolding of care-giving for technologies.

With multiple teachers for each session at the Fab Lab, students were assisted individually when they encountered difficulties. Sometimes these were minor fixes, such as restarting the software. Other times it was more complicated, where multiple teachers became involved and yet still could not resolve the issue to return the student and their computer to our pre-determined course itinerary. In these instances,

[3] In digital gaming communities, a *mod* is a shorthand term to describe a modified iteration of a game that players have created, and *modding* is used to denote the practice of creating modifications.

[4] This workshop series was developed by revising previous workshops I had taught in the same location, and it was created in connection to my dissertation work.

the pedagogical strategy that we developed was to flag the issue for the more technical staff employed to conduct routine maintenance on these machines after sessions. In the meantime, the student was provided with another surplus computer or, in the rare event, placed to share a computer with another student. And they continued course as per the pedagogical plan.

The library sessions, on the contrary, only included me as the teacher. As such, when such moments occurred, the whole session paused while I attended to an individual student. In the meantime, other students proceeded to experiment with the tools provided by staying with the tasks at hand or began browsing unrelated content on the Internet. Often, more than one student sought my attention to attend to the trouble they faced, and I simply could not attend to them all at once. As such, students tried to resolve the trouble on their own, to varying degrees of 'success,' while they awaited in que for my individual assistance. Unlike the Fab Lab, I began making the technological troubles we encountered a central part of my pedagogy. As we didn't have surplus resources standing by nor did we have access to technical staff after sessions, I foregrounded the situation one student encountered and invited everyone to engage through suggestions or research, especially when I also didn't understand what care the trouble needs. This often resulted in our sessions changing direction and only finishing a few tasks that I had devised ahead of time.

More planning... but toward what end?

As I shared these frustrated stories with colleagues at professional gatherings, I learned that I was far from alone and that this phrase 'technology never works!' was commonly repeated by them as well. The wisdom shared among experienced educators maintain that perhaps this phrase is our key to better practice. Specifically, this phrase as a guide to bettering our pedagogical practice translates to revising our expectations to assume failure not as the exception but the norm. Assuming failure is the norm, many educators recommend preparing technology back-up plans, which are 'back-ups' in name only, to reach the original learning objectives in the expected event of technological troubles. Multiple blog posts and think-pieces exist online to support educators developing back-up plans; "If we know that technology is going to fail at some point," as educator Melissa described in the Association of American Educators online blog, "then we should be prepared for that to happen" (2018, para. 2). In other words, if failure is the norm, then it just means that educators need to do more work by planning more on top of everything else, to bridge the gap between the promises of technology, as promoted by national campaigns and aspirational discourses of #edtech, and the actuality of technology, as practiced daily and used as metrics for assessments, in education.

However, I question the sustainability and equity of this strategy of *planning more* as the only response to continuously emerging technological troubles. Because defaulting to plan for the inevitable failure requires us to presume that any of technologies' leaky parts *can* be controlled, contained, and eliminated. Because defaulting to plan for the inevitable failure with surplus machines requires us to presume that teachers and students *have* extras of these expensive technologies standing by in their environments. Because defaulting to plan for the inevitable failure by extending the maintenance tasks for teachers and staff to before and after lessons requires us to presume that the labor of caring for technologies are their *responsibility* only. Because defaulting to plan for the inevitable failure with back-up activities

paradoxically requires us to presume that we *need* to include emerging technologies as if they are somehow inherently good and necessary for education, but that we *can* proceed in our desired learning directions despite them. But if we can engage with our set-forth learning objectives with paper and pencil, why did we assume we need to use the laptops in our activities to begin with?

Taken together, the impulse to plan against messy failures expresses a liberal humanist desire to maintain a normative temporality of education, whereby learning is about reaching a pre-constituted and pre-determined destination: becoming human with the proper (technological) literacies. Under a normative temporality of education, these troublesome moments when technologies demand care during, and perhaps redirect, teaching and learning are presumed to be bad and must be removed. To proceed with these assumptions by *planning more* is to fuel what S. Craig Watkins termed the "deficit narrative" (2018, p. 3) of technology use, particularly amongst marginalized populations that engages with emerging technologies in ways that do not mirror their advertised and idealized fantasy. At the expense of an "asset narrative" that foregrounds "what they do have" in terms of "innovative techno-dispositions and practices that have led to important modes of digital expression and community" (p. 3), Watkins noted that in existing literature there is "an almost exclusive examination of what black, Latino, and lower-income youth *do not have* in relation to a rapidly evolving tech landscape" (p. 3, emphasis added). This deficit narrative relies upon a prefixed imaginary of what constitute a legitimate technological literacy and how emerging technologies *should* be engaged. Arguing against deficit narratives in the field educational technology, Julia Thornton demonstrated that the logic of deficit relies upon constructing digital literacies as a standardized novice-to-expert continuum, whereby the novice's distance to the expert expresses a "developmental deficit" (2014, p. 324). I argue that this developmental deficit logic undergirds the impulse for more planning, whereby technological literacies and expertise are pre-constituted and require following a preset itinerary of technological engagement to achieve.

Between the two sites recounted in this paper, the glaring distinction to be made is that of class and its resulting resource differences. Students had to pay tuition for Fab Lab camps, with limited reduced tuition spots available; they had access to transportation to travel onto a university campus with limited housing for non-university people; most of their caregivers were affiliated with the university. On the other hand, students didn't have to pay any fees to access the services at the public library; they mostly lived nearby the library in downtown; most of their caregivers worked outside of the university. Under this context, to subscribe to the idea that encountering technological troubles is bad is to privilege educational experiences that (can) minimize those moments. In so doing, it privileges what the Fab Lab had (e.g., extra technologies, teachers, and staff) against the backdrop of what the library didn't have under a deficit narrative to further reinscribe and solidify existing socio-cultural capital hierarchies as metrics to assess learning. In other words, to subscribe to the logic of developmental deficit that constructs digital literacies as a standardized novice-to-expert continuum is to privilege learning experiences at the Fab Lab that were afforded with a technology back-up plan, made possible with access to capital and resource invested ahead of time, for students to develop their technological literacy in ways that resemble their advertised function. And this plan against messy technological troubles also suggest to students that learning is about returning to the lesson plan and relegating the care-giving tasks for someone else to perform.

But, to rely on more planning to return students back onto a streamlined itinerary of moving from a devalued novice position to a prefixed tech expert destination is to further solidify the metrics that racialize, class, and gender bodies based on their proximity to emerging technologies, whereby what constitute expertise in digital literacy and who can acquire such digital literacy are already predetermined. And if we prioritize learning experiences that were afforded with a plan to sidestep messy moments of technological trouble for returning to a standardized novice-to-expert continuum of technological literacy, we not only foreclose the potential to better understand how emerging technologies affects education (and what literacies are made) in practice but also further reinscribe the troubling logic of developmental deficit. To proceed with more planning as the only response, then, is also to foreclose what Kylie Peppler, Jennifer Rowsell, and Anna Keune (2020) have called for: a "pivot away from a sole focus on learning toward a broader conception of how we experience the world as humans intra-acting with matter" (p. 1241).

Most importantly, in removing moments of care-giving out of the normative temporality of teaching and learning, we risk proceeding to sustain the technoliberal myth that technologies magically work on their own. As opposed to foregrounding the contextual constraints and infrastructural politics, we sustain larger fantasies of a universally functional technology and an idealized functional relationship with these technologies when we insist on removing these uncomfortable troublesome moments by extending the amount of behind-the-curtains labor that teachers and staff must perform outside of lessons. If we don't want to reinscribe existing socio-cultural capital hierarchies as metrics to assess learning, the differences between the two educational sites narrated here point toward the need for more nuanced analysis of our pedagogical practices with our nonhuman companions that does not rely upon the logic of deficit to interpret technological troubles. And to refuse this logic of deficit, we must first question the impulse to plan for these 'inconvenient' moments of technological trouble. We must question how such planning encodes desires to remove the labor of caring for technological troubles in education out of bounded instructional periods that serves to perpetuate the myth of technoliberalism, whereby work that goes into sustaining emerging technologies are planned for some other people in some other place and time.

Conclusion

In this paper, I linger on moments of technological troubles encountered during teaching and learning and consider what these moments imply for educational research through a posthuman approach. Building on existing theorizations, concerns, and applications with the posthuman, I foreground a posthumanist approach that refuses the myths of technoliberalism, as an extension of liberal humanist education, to address the uneven proximity to humanness, subjecthood, and emerging technologies based on intersectional embodiments. Specifically, I argue that to consider the posthuman in educational research necessitates us to examine the often taken for granted and yet crucial labor that makes encountering technologies possible in the first place: the labor of caring for technologies. I propose a posthumanist methodological approach centered on the *care-giving labor* for *emerging technologies* performed by *teachers along with students* during *moments of technological troubles* within bounded instructional periods. Using this approach, I turn to count, recount, and account for the labor of caring for emerging

technologies during moments of technological troubles in my own pedagogical encounters at a Fab Lab and a public library. Here, I focus on how I, alongside others in those moments, responded to technological troubles in the classroom, and the common advice to increase planning ahead of time to minimize such technological troubles. Instead proceeding with this advice, I complicate its implications.

Specifically, I argue that the impulse of *planning more* may be preventing us from following through the generative lines of inquiries opened by these emerging technologies in these troublesome moments. If we take seriously Snaza and Weaver's (2015) argument that planning is central to the liberal humanist tradition, what future possibilities of working for, with, through, under, and against emerging technologies do we foreclose when we plan to sidestep the labor of care-giving at every corner of the pedagogical encounter? What are the implicit assumptions encoded into our pedagogical practices when we relegate the labor of care-giving for emerging technologies to some other time, some other place, by somebody else? Given the resource disparity in accessing idealized technological encounters, I argue that the impulse to plan for and the act of deferring the care-giving labor outside of classrooms rely on a set of unsubstantiated premises and translate to troubling implications. For one, it further reifies the intersectional hierarchy of marginalization in relation to emerging technologies by foregrounding a developmental deficit model of technological literacy. For another, it risks sustaining the technoliberal myth of technologies as postracial and postlabor. For yet another, it extends the already overloaded amount of behind-the-curtains labor that teachers and staff must perform outside of lessons. Instead, I wonder: What would teaching and learning look like if we, educators, approached the labor of caring for emerging technologies not as irrelevant tasks to be removed from instructional periods but as important lines of inquiry to follow with our nonhuman counterparts whenever we encounter technological troubles? I hope we can find out.

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