Teaching Neuroethics in a Time of Crisis: Lessons in Liberatory Pedagogy

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Introduction

Crises lay bare the core values around which institutions are organized. A crisis represents a state of overwhelm, a system pushed to the limit of its capability to adapt. Crises may occur within the lives of individuals or at broader societal and ecological levels. They may take the shape of an acute illness, floods on a warming planet, or a pandemic. Disasters may originate within the natural world, yet a state of crisis is crafted and perpetuated within human activities. Crisis invariably creates opportunities for power to assert itself.

Nevertheless, crisis may also present opportunities for liberatory and humanist modes of change, and education is central to such capabilities. It is a testament to this potential of education that recent crises have elicited such reactionary attacks on educational institutions and educators, including crusades against the teaching of critical race theory and LGBTQIA+ educators and students. An intentional, values-informed approach to STEM fields and to education is needed to counter reactionary narratives and responses to crisis.

STEM teachers and researchers may feel a sense of remove from political problems (science has long been touted as objective, detached, and apolitical); nevertheless, science is a fundamentally social activity, anchored in time and place and requiring substantial collaboration. I echo Helen Longino's (1990) observation that "it is the social character of scientific knowledge that both protects it from and renders it vulnerable to social and political interests and values" (p. 12). At present, problems such as climate change, disparate illness outcomes, and revelations about scientific racism, sexism, and ableism challenge STEM educators to more explicitly consider values in their work.

Students in STEM classes will become future scientists and educators or will otherwise make use of scientific knowledge in their lives. These realities further invite teachers to act responsibly in their roles and to welcome values, ethics, and critical methodologies into the STEM classroom. I respond to these challenges as a neuroscientist, ethicist, and educator with a deep commitment to liberatory pedagogies. Neuroethics, as a discipline, centers the critical analysis of the scientific study of brain and mind and informs the totality of my teaching in neuroscience. In this chapter, I

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describe how teaching neuroethics through a liberatory lens has facilitated students' ability to think critically, name and examine values, and take nuanced and historicized perspectives on neuroscience-related topics, even as the COVID-19 pandemic and other recent crises unfolded. I expand on how my own theoretical foundation in liberatory pedagogies and understanding of critical consciousness shaped the design of course curricula and classroom spaces during the pandemic and illustrate how such critical methodologies may alter engagement with power in the sciences. Finally, I provide practical insights and applications from the neuroethics classroom. Throughout, the neuroethics view, informed by critical methodologies, allows for novel conceptualizations of accountability and justice (Hue, 2020).

Author Positionality

I am a multiracial, Asian American, light-skinned, bisexual, queer person. I live with chronic illness. I benefit from a high-quality education spanning community college and a Ph.D. I have been engaged in learning, memory, and mental health-related research and teaching for almost 20 years and have also become a practicing clinician. Together, my social identities, interdisciplinary knowledge, and values have shaped my presence in science as well as my teaching philosophy and methods. Being raised across cultures, in an ambiguous skin, made me more comfortable with ambiguity and complexity, and being without generational wealth helps me to recognize financial limitations on time, attention, and options. I confront oppressive legacies and the workings of power in the sciences, and I have learned to be curious about how dimensions of identity shape the science classroom and students' experiences therein. My dimensions of positionality confer special awareness for marginalized perspectives that are similar to my own while obscuring other marginalized experiences and knowledge forms. The concept of cultural humility (Abe, 2020) reminds me that each student is the expert in their own social identity and experience. With awareness of my own positionality, I can attend to their perspectives and craft spaces more conducive to their learning.

Critical Pedagogy and Liberatory Process

In *Pedagogy of the Oppressed* (1970/1993), Paulo Freire inscribed key theoretical and practical foundations of critical pedagogy upon which others continue to expand. This approach toward pedagogy may encompass goals of inclusion but transcends them. Critical pedagogies seek transformed relationality between teachers and students, with a flattening of the hierarchies that characterize traditional classrooms.

Central to critical pedagogy is *conscientização*, a practice of critical thinking, collective awareness, theory building, and action. This stands in contrast to the "banking model" of education (Freire, 1970/1993, pp. 53-54, 90), where a supposedly

omniscient and omnipotent teacher deposits information into the minds of passive students. Critical pedagogy rejects the assumption that learners are so fundamentally blank, proposing instead that students and teachers both shape the learning process. Through a critical dialogue that encompasses their socio-historical context, they may come to understand the world together.

An attention to power dynamics that subverts the authoritarian structure of traditional classrooms is one key principle of critical pedagogy. Another is concurrent engagement with theory and praxis; theory is meaningful inasmuch as it connects to the material conditions of the world. As students and teachers name the world together, they also act together. This process requires dialogue and mutuality, a reflexive collaboration in the classroom and beyond.

In accordance with these principles, critical pedagogy requires learning in communion with one another and with surrounding ecosystems (Freire, 1970/1993, pp. 62-63). Freire argues that critical pedagogy is a relational practice requiring *intersubjectivity*, a recognition of the value, personhood, perspective, and agency of the other (e.g., teacher and student). This also engenders spontaneity, liveliness, and creativity, in contrast to the deadness of authoritarian, dominating forms of education (Freire, 1970/1993, p. 58). The liberatory classroom is a living organism.

Education for critical consciousness is playful at its best but has serious stakes. Teachers and students embark together on a project of intellectual and material liberation. In this process, one does not liberate the other (an impossible endeavor; Freire, 1970/1993, pp. 75-76). Rather, the liberatory process entails "doing with" rather than "doing to." This critical, relational process also differentiates between the revolutionary process of *conscientização* and either bureaucratic or rigid sectarian thinking. The liberatory process is itself fraught with problems of power, including dangerous hero fantasies about idealized leaders. Akin to this is the danger of investment in a tokenized few representatives of oppressed identities who may enforce the norms of unchanged oppressive structures. A liberatory goal, rather, is that all participants become "subjects who meet to name the world in order to transform it" (Freire, 1970/1993, p. 148).

The scholar and educator bell hooks (Gloria Jean Watkins) was one of the most prolific U.S. practitioners of critical pedagogy. In her own indispensable work, *Teaching to Transgress* (1994), hooks explores both her connection to and ambivalence about Freire; she is known for expanding Freire's analysis of power and oppression to include the "interlocking forms of domination" (hooks, 1989a, p. 25) known as gender, race, and class. hooks' theorizing dovetails with her contemporary Kimberlé Crenshaw (1989, 1994), who introduced the framework of *intersectionality* within legal analysis. hooks recurrently explored love as a defining feature of the feminist, liberatory classroom (hooks, 1989b; 1994, pp. 198-199) while simultaneously embracing productive conflict and confrontation, which she saw as central to the project of critical consciousness (1989b; 1994).

Other authors, such as Maurianne Adams and Barbara Love (2010), examine how liberatory educational practice aligns with contemporary "diversity" rhetoric within universities. These authors emphasize that simply adding diversity in admissions is not enough; the quality of the educational environment must be cooperative, consistent, and supportive. Regardless of institutional rhetoric, these authors also note that many faculty continue to teach from familiar, authoritarian traditions predicated on the "banking model." The authors employ a social justice argument for adopting liberatory educational practices, and they place the leveling of power at the center of meaningful equity and inclusion.

Adams and Love (2010) propose a four-quadrant model that may be used to analyze and assess liberatory, social justice-focused teaching and learning. These four quadrants include:

> (1) what our students, as active participants, bring to the classroom, (2) what we as instructors bring to the classroom, (3) the curriculum, materials, and resources we convey to students as essential course content, and (4) the pedagogical processes we design and facilitate and through which the course content is delivered. (p. 7)

This framework may be used to identify the positionality and strengths of students and instructors and to help classroom participants to reflect on social identities and exercise perspective-taking skills. Such models may be helpful in linking theory to pedagogical practice. Nevertheless, Adams and Love (2010) also argue that social justice goals require transformation at institutional and societal levels, in addition to self-reflexive practice and changes within the classroom. They note particular difficulties with introducing social justice perspectives in STEM fields while recognizing potential rewards in doing so: greater insight, connectedness, and well-rounded views on important problems.

As a group, these theorists converge on the importance of flattening power differentials, developing more authentic interpersonal connections, and joining theory with praxis. In recent U.S. culture, however, the language of justice has come to be framed largely in terms of diversity, equity, and inclusion (DEI), a set of activities often overlapping with the pre-existing academic language of "multiculturalism." It is important, however, to be cognizant of the limitations in DEI frameworks and the dangers of co-opted social justice language, what Vijay Prashad (2010) terms the "bureaucratic approach to the problem of diversity" (p. 121).

Contemporary efforts toward diversity, equity, and justice within U.S. education developed as a result of civil rights demands and have consistently received pushback since its implementation in the 1960s, its goals unsurprisingly at odds with monied white power structures (hooks, 1994, pp. 29-31; Prashad, 2010). These efforts, however, not only faced outright suppression but additional co-optation as,

in the words of hooks (1994), "the stuff of a colonizing fantasy" (p. 31). Prashad (2010) explores how multiculturalism was diluted into colorblind ideologies and model minority myths, adopted as institutional commodity and used to forestall transformation within institutional hierarchies (pp. 123-124).

Feminist scholar Sarah Ahmed (2012) describes "diversity" as a potential exercise that "evokes the pleasures of consumption" (p. 69), as "a form of public relations" (p. 143), and inclusion as a potential "technology of governance… those who in being included are also willing to consent to the terms of inclusion" (p. 163). In the absence of *conscientização* as process, DEI language and technologies may be manipulated to sustain oppressive institutions and practices. Those seeking to engage in liberatory practice would be wise to remain aware of such dynamics.

Critical Consciousness in STEM Education

Contemporary liberatory pedagogies were born within the brutal, mid-20th century constructions of economic and political crisis so well documented in Naomi Klein's (2007) *The Shock Doctrine*. Such tactics of crisis, shock, and political and economic restructuring were repeated worldwide, informing events from the overthrow of Latin American democracies to responses to natural disasters such as 2005's Hurricane Katrina in New Orleans (Klein, 2007). The common threads in these states of crisis, per Klein, include both explicit actions and selective inaction and institutional neglect that disproportionately target marginalized populations and consolidate power in fewer hands.

Freire was one of many Latin American radical educators and artists facing oppression by military regimes employing US-backed tactics of economic "shock." A military coup toppled Brazil's government in 1964; the junta quickly escalated to overt torture and terror. Freire fled Brazil, living in exile within the US. This "shock therapy" allowed the architects of the coup to dismantle the Brazilian state and open the nation for economic exploitation; the regime recognized liberatory educators as enemies. Liberatory pedagogies must indeed be understood as a confrontation against cultivated states of crisis and their accompanying ideologies. When hooks explicitly orients herself against the racism, sexism, and "alienation" of the university (1989a; 1989b; 1994, pp. 5-8), for instance, she assumes a deliberate position of resistance. In this tradition, I argue that critical pedagogy is urgently needed in the sciences to resist narratives of alienation and domination within crisis.

In a heated state of crisis, it may be easy to ignore the complex social and historical context of key problems precisely at a time when they are most important. The history of science is rife with oppressive constructs, yet I have found that many STEM majors learn little, if any, of this history. Students may understand eugenics, for instance, as the opinions of individual bad actors rather than frameworks that justify oppressive social structures. Students with marginalized identities may feel

estranged from scientific subfields without knowing why; those born with power and privilege may struggle with defensiveness when engaging this history. Liberatory frameworks can build the intellectual and relational capacities for a critical, historicized engagement with the sciences.

Many contemporary oppressive practices have their historical roots in biological theorizing about social categories such as race and gender. These narratives may elevate certain populations as ideal and construe others as less human or inferior. They often do so by referencing a point of physical difference (e.g., skin color, reproductive physiology) and making spurious claims about evolutionary processes (see Gould, 1996; Schiebinger, 1993; Saini, 2019). These arguments may involve both inept and selective interpretations of evolutionary theory (Fuentes, 2012, pp. 3-4) and outright fabrications.

An example: the 18th-century European anatomist Blumenbach took a liking to the skull of a young woman from what is now Georgia (Schiebinger, 1993, pp. 150-153). Blumenbach's praise for the beauty and symmetry of this skull, taken from the Caucasus mountains, provided fuel for the construction of an idealized race of people. "Caucasian" became a categorical term for white people of European descent and a reference point for a destructive race science that continues to this day.

Another example: the woman known as Saartje Baartman (her true name is unknown) was bribed into traveling from what is now South Africa to Europe with so-called European men of science. She was abused: subjected to bizarre, sexualized curiosities about her body and exhibited in Europe's human "zoos" (Schiebinger, 1993, pp. 168-172; Saini, 2019, pp. 39-41). The writings of these men provided more fuel for Europeans' generalizations about, and denigration of, the bodies and minds of Black Africans and contributed to the scientific construction of racialized "others."

The practice of measuring skulls (Gould, 1996, pp. 105-141) lingered for many years as a malignant subculture of race science aimed at reifying supposed categorical differences in intelligence and mental fitness. More recent efforts in the same lineage invoke essentialist claims about average brain differences and disingenuous uses of genomics to justify racial and gender hierarchies (Fine, 2012; Saini, 2019, pp. 103-124). Such scientific narratives are not morally neutral or apolitical. They provide intellectual cover to white supremacy and related cis-heterosexisms, ableisms, and other oppressive philosophies. It is no coincidence that these dehumanizing narratives flourished during the aggressive expansion of European colonies (Saini, 2019, pp. 21-24), where scientific construction of racial/gender hierarchies was used to justify a "civilizing" mission and, thus, Europe's claims to the lands and resources of others.

Science education is inextricably entangled with this history of crisis and conquest. One need only consider the periodic resurgence of racialized, gendered, and classed hierarchies of intelligence (Gould, 1996, pp. 26-50; Saini, 2019, pp. 90–92, 95-102), often used to argue that educational resources are wasted on "lesser" classes

of people (Panofsky, 2015; Comfort, 2018). Yet the construction and usage of STEM knowledge does not need to be fundamentally oppressive; this usage is a choice. What would it look like to make different choices concerning the structure of scientific disciplines, power relations within them, the questions asked, people retained, and employment of scientific narratives? What would it look like to abandon questions about who belongs at the top of the heap? To transcend these patterns of power and domination requires a different approach. This is what critical pedagogy offers.

A liberatory STEM education requires a foundation in history and critical analysis. Liberatory process also emphasizes the interconnectedness of people with each other, their environment, surrounding natural phenomena, and scientific processes. These processes of sociohistorical analysis and relationality go hand in hand, countering the artificial distance of students and instructors from their social positioning, countering states of alienation and dissociation. Liberatory processes position students, teachers, and their various ecologies as companions in scientifically understanding and acting on the world. This is, in short, the binding of theory and praxis in *conscientização.*

Recent years have seen efforts to address discrimination in STEM fields, with arguments tending toward the multicultural. Diverse views, it is argued, allow science to be increasingly relevant, accurate, and useful. These are fine arguments, but these fields still struggle to move beyond DEI platitudes and travel the road toward liberatory practices. This may reflect frank antipathy toward such practices, yet it may also reflect a worry that they are too difficult to implement. To such educators, I would offer hope. Critical pedagogy is an ongoing process and not an endpoint; change may feel challenging, but it is possible.

Critical pedagogy, as a framework, inspired my earliest teaching days and my research into learning and memory. These methods have allowed deep insight into scientific concepts and a self-motivated interest in learning. They have encouraged sincere connection and creativity in classes. The more immediate changes required in such a liberatory practice include greater self-reflection (for all parties), explicit naming of power, and changes in how power is given and taken in science classrooms. A shift toward liberatory pedagogy at some point requires an overall reassessment of the classroom environment, which is key to engagement with the projects of learning and critical consciousness. Students must be able to take risks and experience both enjoyment and productive discomfort while unlearning punitive expectations of education. Students may also have personal historical connections to oppressive practices within the sciences; trauma-informed practices (Brunzell et al., 2019, expanded on later in this piece) are imperative.

Liberatory practice is often limited by educational institutions that are stubbornly resistant to change. To work in such places requires a constant, critical awareness of how we, students and teachers, comply with hierarchical power relations and exclusionary practices. With this limitation in mind, STEM fields desperately

need practitioners from liberatory traditions who are willing to view and construct power differently. Consolidated power, as illustrated by Freire, becomes ever more rigid and short-sighted. This is untenable when addressing problems as expansive as climate change, emerging pathogens, or health care justice. If ever there was a time for a living, dynamic, and liberated science, it is now.

Course Design

Practical Insights from the Neuroethics Classroom

Studying ethics can be a key component of the critical consciousness that students may carry into their social and work lives. Neuroethics casts a critical eye on the brain sciences, requiring not only basic proficiency in neuroscience but the ability to interpret scientific findings and narratives within their socio-historical context. Students in my classroom learn to take multiple perspectives and to question how neuroscientific knowledge and technologies may be used to help or harm. They may ask questions about power and participation in the sciences. They may learn to avoid the traps of biological *essentialism* in their own work. They learn the basics of logic and argumentation, become more skilled in articulating key values, and apply these skills to real-world dilemmas. Such skills are invaluable in understanding and responding to crisis and may confer resistance to misinformation.

From 2019 to 2021, I taught *Neuroethics* as an advanced undergraduate offering. Since the summer of 2020, I have taught a graduate *Behavioral Neuroscience* course, also neuroethics-based, for counseling and school psychology graduate students. In these classes, we have covered topics ranging from cognitive enhancement (Maslen et al., 2014) and implantable neurotechnologies (Mayberg et al., 2005; Kubu & Ford, 2017) to definitions of brain death (Bernat, 2014; Fins, 2016) and environmental neuroethics (Cabrera et al., 2016; Tesluk et al., 2017). We have discussed the neuroethics case against solitary confinement (Lobel & Akil, 2018) and the neuroethical implications of U.S. policies that have separated children from their parents at the US-Mexico border (Teicher, 2018).

In these classes, we discuss how neuroscientific terms and technologies can be "hyped" and sensationalized (Caulfield et al., 2010) and how these concerns inform our obligation to responsible science communication. We observe tentative cross-cultural neuroethics collaborations beginning across the globe (Rommelfanger et al., 2018). We also discuss pitfalls of biological gender essentialism (e.g., Fine, 2012) and consider how oppressive theorizing can be replaced with a more complex, liberatory view on neuroscience, gender, sex, and sexuality (Gupta, 2012; Cipolla & Gupta, 2018). Through these conversations, we engage with the history of biology, and in so doing, we enter into a critical analysis of how neuroscience is constructed and used. For future coverage of these historical topics, I highly

recommend Angela Saini's (2019) *Superior: The Return of Race Science*. Saini's work not only accessibly covers the historical context of European sciences in greater depth but establishes continuity with ongoing political battles within the biological sciences as they traverse the early 21st century.

A number of practices contribute to an environment conducive to liberatory pedagogy. Course assignments are one key area for intervention. I create a flexible yet structured assignment schedule, with student input, at the start of a course. Students endorse the utility of structured due dates; flexibility then allows for fuller participation of disabled students and those juggling family duties or other important responsibilities. What this means is that I clearly define course assignments and provide tentative "due dates" at the start of the semester. Students and I then have a conversation about how to take extra time when they need it. I offer a standard grace period (from two days to one week) with no explanation needed for most assignments and additional extensions when feasible. While larger classes require different management, approaches that are both structured and flexible can apply to courses of any size; for instance, greater flexibility and control can be achieved simply by providing students with some choice about which assignments to complete (e.g., dropping assignments). Often, students report lowered stress, work is improved, and instead of negotiating due dates, we spend more time discussing ideas.

These strategies begin to move a classroom toward *universal accessibility*, which seeks to remove constructed barriers to learning. Issues of access and disability justice are beautifully addressed by Johnson et al. in this collection. "Universal Design" stands in contrast to the accommodations approach to disability, which usually entails onerous and intrusive documentation. The burdens of accommodation and the urgency of "academic ableism" are addressed at length by Jay Dolmage (2017) who also makes crucial links between ableism in higher education, its history within colonial violence and eugenics (pp. 11-20), and the potential co-optation of Universal Design, like multiculturalism, within the neoliberal university.

The fact is, minor modifications can help a wide range of students to participate more meaningfully in learning. For instance, I design universally extended testing periods for quizzes and exams; time trials are rarely useful or appropriate. A class will usually require at least twice as long as an instructor does to take the instructor's test, and I aim to provide students with time and a half beyond that (e.g., if I finish my test in 25 minutes, most students finish in 50, and time and a half can be given in a 75-min. period). Online, the time window for an exam can be extended even longer (hours or days) with questions of greater complexity that assess understanding. For instance, in such an assessment, I may ask students for an experimental design that would answer a research question or apply ethical concepts such as autonomy and justice to a hypothetical clinical case (e.g., brain injury or dementia).

I most often do not use exams in my neuroethics courses; if I do, I will not use surveillance software for remote testing. This is particularly salient for neuroethicists

who are concerned with the unregulated infiltration of digital platforms into people's lives. Such software raises ethical concerns about privacy, consent, and the corrosive impact of widespread surveillance. These may include "lockdown browsers" or more extreme software that captures test taker movements, including eye tracking technologies to detect "cheating." Among other technological and bureaucratic nightmares, such technology has demonstrated racist bias and is untenable for students with certain disabilities (Barrett, 2023).

Similarly, software that detects plagiarism (overlap with available sources) must be used with care. Instructors who use such software must be competent in its use as an instructional tool and aware of its limitations. While instructors express understandable frustration and concern about plagiarism, the problem itself is a complex product of stress within educational systems and online norms and attitudes about writing. Usual responses are punitive in accordance with institutional norms. A liberatory lens, however, may reframe the problem of plagiarism as one of power, motivation, and trust. This shift in perspective also reframes the uses of writing assignments.

From a critical perspective, the teacher must wonder why a student's instinct is to adopt the words of others. I have heard students worry that their own words don't sound polished enough. They may be anxious or numb. Some are even convinced that they don't have ideas worth expressing. Plagiarism signals the student's alienation and despair, marking a systemic failure; widespread cheating and plagiarism are products of rigid, commodified, and impersonal banking models of education. Students in such a system are incentivized to avoid punishment while simultaneously seeking the highest possible grade with the least possible investment. This is capitalistic efficiency; within current societal value systems, the emptiness of plagiarism makes sense.

In my neuroethics classroom, I trust that students can learn while experiencing a range of excitement, discomfort, and ease in the classroom. Not driven by threats, students can enjoy creating and talking about their creations. Assignments based in creativity and used as a basis for discussion can be rich ground for connection, critical analysis, and growth. I have often seen this dynamic at work when making comics to explore thorny neuroethical issues (Fink, 2020b); students may draw one-panel or one-page case narratives and use them for in-class discussions of ethical dilemmas. Students may also complete similar written assignments, which are framed as a semester-long project in learning to express their stance on an issue. Early in this process, students who struggle with expressing themselves benefit from sincere encouragement and validation. Shorter, low-stakes exercises provide them first with the opportunity to create and for the creation to be received with joy. If they move beyond early discomfort, they may gain intrinsic motivation to create, enter into more authentic communication with peers, become better able to receive and give feedback and shape their own intellectual growth. Examples of assignment prompts can be found in Appendix A.

Assignments bring the specter of grading, a practice that is difficult for most instructors to avoid completely. It can be useful, again, to reconsider punitive strategies that place undue focus on a grade rather than the learning. Educators might instead make a habit of asking themselves: 1) What is the important learning that needs to happen? 2) How can students be given adequate and equitable opportunities to demonstrate that learning? This reassessment of values is fundamental to the practice of *ungrading*, the use of which in STEM classrooms is discussed by Newell-Caito in this volume.

Upon re-examination, certain assignments, grading practices, and micromanaging rubrics may appear newly onerous and unnecessary. Many of my assignments, particularly early ones, are graded on full completion and originality, prioritizing learning process over product. For instance, students may be asked to answer a few key questions and offer reflections on class readings. They receive feedback on their answers, emphasizing process, but their grades simply reflect whether they answered each question. I also engage students in discussion about what they would like to express through their work, making sure that they know their ideas and interests are valued. This approach builds competency and confidence; students organically learn to tackle more challenging reading and analysis, and they learn about their own interests.

This classroom approach also represents a thoughtful balancing of emotional arousal based on longstanding insights from stress neurobiology. Stress exists on a continuum (e.g., Herman, 2013); moderate, temporary stress can be beneficial, enhancing learning and engagement. Extreme, unremitting stress, however, is destructive to attention, emotion regulation, and learning. A well-functioning classroom may aim for a window, the peak of this curve. Students should be engaged, alert, and even productively uncomfortable at times, but they should not be stressed beyond capacity or, importantly, outside of their reasonable control. Using this window effectively is an important teaching skill; a neuroethics view might argue for the importance of trauma-informed classrooms based on an awareness of disproportionate exposure to stress in distinct populations of students (Brunzell et al., 2019).

As within health care (Sweeney et al., 2018), trauma-informed classrooms emphasize choice, collaboration, safety, and trust. One component of such a classroom might be content notifications: for instance, noting potentially activating content that depicts racism, sexism or sexual assault, or other forms of violence. There is no way to avoid (or identify) all individual trauma triggers, but avoidance is not the point. Instead, a thoughtful content notification can normalize the fact that students may have strong emotional reactions to material and open such topics for discussion. They may then prepare and make choices about *how* to engage. The class may also collectively discuss coping strategies. This brings up other key ingredients that can be easy to implement, including an upfront discussion about the classroom environment and the co-creation of a classroom agreement that helps to shape an atmosphere of exploration.

A brief, optional, pre-course survey (see Appendix B) has proven useful for me, and anecdotally, for others, in managing access and participation in virtual and in-person classes. My teaching and learning survey inquires into students' accessibility (technological and disability) needs, concerns about the ongoing impact of the COVID-19 pandemic or other current issues, how they might best engage with the class, and their interests. Using this tool, we can address questions and concerns together in advance. This is also one way in which I convey my respect for and interest in students' experiences. Even partial co-construction of course policies is central to transforming more authoritarian course structures into more equal, discursive ones.

In-class activities breathe life into a course. I rely heavily on student-led discussion and creative methods such as comics, and drawing is central to my teaching practices (Fink, 2020a; 2020b). Creative tools can allow deep engagement with emotionally difficult topics and may allow students who are "stuck" to find their voice. Drawing may also elicit understanding that is not apparent in verbal communication. "Drawing-to-learn" (Quillin & Thomas, 2015) is effectively used by others in biology. In an excellent recent example, Edlund and Balgopal (2021) demonstrated how drawing could be used to communicate cross-cultural and spiritual meanings of neuroscience.

Artistic and narrative methods of learning may also encourage perspective taking, cultural humility, and new ways of considering social responsibility and justice. Creative approaches often provide new avenues toward critical analysis of course material. As an example, I recall using comics to explore students' imaginings of gender and biology. It was only when one student drew their depictions of gender that they noticed the many stereotypical physical features that they unconsciously assigned to their stick figures. They expressed astonishment and a realization that the image revealed a mental representation of gender that their words may have overlooked. Their insight then sparked a transformative class discussion on biological essentialism in neuroscience.

When they are making art, students are laser focused on the material at hand and more open to meaningful, spontaneous, and joyful connection between classroom participants. This is the living thing that Freire wrote of as critical consciousness (1970/1993), and this, in part, is also what bell hooks spoke of as love.

Liberatory pedagogy requires practical actions: a welcoming and vital atmosphere, policies and assignments that allow students to best demonstrate their learning, feedback, and evaluation that emphasize student strengths over punishment, and non-coercive opportunities for interpersonal connection and critical evaluation of course materials. Teaching neuroethics provides unique opportunities for such pedagogy, with key moments of insight about the biopsychosocial process of learning itself and opportunities to discuss real-world issues. When students bring discussion items and artistic creations into class as equal participants, their

contributions lead to deeper and more satisfying conversations. These practices have proven their utility throughout the U.S. crises of the 2010s and the ongoing COVID-19 pandemic.

Developing Critical Consciousness During the COVID-19 Crisis

This chapter took shape during the second and third years of the COVID-19 pandemic and was molded by crises specific to this period. As the SARS-CoV-2 virus spread across the world, the WHO in 2020 urged countries to "take urgent and aggressive action" (World Health Organization, 2020). Employers and educational institutions made dramatic shifts to remote activities. Reasonable accommodations previously considered impossible or unfair (Burgstahler, 2021; Pak, 2020) were immediately implemented. The pandemic starkly illuminated the ableism of U.S. institutions and the failure of eviscerated American public health and healthcare systems. Long-standing impacts of structural racism and ableism resulted in disproportionate illness and death in marginalized communities (Acosta et al., 2021; Chowkwanyun & Reed, 2020; Quan et al., 2021).

The summer of 2020 also saw a revitalized movement to repudiate white supremacy and police brutality against Black Americans and to promote the flourishing of historically oppressed populations. Nevertheless, 2021 began with a white supremacist attack on the U.S. capitol, and targeted attacks against Black and Asian Americans continued. Populations with the least wealth and power continue to be most negatively impacted by the COVID-19 pandemic and its ensuing crises.

An orientation toward critical consciousness proved invaluable while teaching during this time, where sequences of crisis and "shock" and the politicized and social nature of science were so apparent. My neuroethics-based classes offered opportunities to contextualize these crises, discuss historical precedents, and build a sense of intellectual community in the face of potentially overwhelming problems. Students also arrived at specific insights through a neuroethics framework. For instance, some students explored the bioethics of inequities in vaccine access. Others found parallels between COVID-19 and the stigma involved in "disease" labeling of mental illnesses (Corrigan et al., 2014) or substance use (Hammer et al., 2013). Discussing long-lasting and neurological impacts of COVID-19 also facilitated key conversations around disability rights and healthcare accessibility.

Virtual teaching and learning became the norm during the pandemic, bringing both new accessibility successes and pitfalls (Burgstahler, 2021) and highlighting existing barriers to participation in the sciences. In an isolating time, many students and teachers appreciated the safety and flexibility of virtual connections, while some encountered new hurdles in access. During the COVID-19 emergency, the federal government also took the unusual step of making emergency funds

available, including resources for digital infrastructure and access. While not perfectly allocated, this aid made a tangible difference for many students. Pandemic-associated services and policies such as expanded internet access, the temporarily expanded U.S. Child Tax Credit, and federal aid for education at all levels provided a glimpse of what is possible; advocating for their continuation and expansion is an unglamorous but needed part of a justice orientation.

Teaching neuroethics in this year also cemented key justice considerations in the classroom. A liberatory approach allowed us to disengage from the frantic pace of the news cycle and to engage in slow, thoughtful analysis. Students reflected honestly on their own presence within STEM fields. They were able to observe how recent crises could be co-opted by those seeking to consolidate their power and how communication about science could be used to political ends. Overall, students expressed appreciation of discussions and assignments that allowed them to exercise their analytical muscle and connect with each other. They also endorsed benefits from drawing and other creative modalities, citing stress relief, opportunities to be more present in classes, and avenues for self-expression.

Summary and Conclusions

To close, I reiterate key features of critical pedagogy within a liberatory STEM classroom: transformation of power from a hierarchical structure to more horizontal forms; cultivation of student and teacher strengths in place of punitive strategies, critical attention to social and historical context, joining of theory and praxis, and attention to interpersonal connection in building knowledge. The instructor brings important expertise to the table, yet they may also plan to leave the classroom transformed. As recounted in this chapter, these critical methodologies were also born of crisis and present a hope for equitable, transformative, liberatory action. While this is indeed a significant undertaking, the process can begin with concrete, actionable steps. Prashad (2010) lists key ideas for the practice of activism on campuses (pp. 125-127). Similarly, I summarize key practical components toward liberatory STEM classrooms:

- Eliciting student input into course policies and structure. Examples: Pre-course survey, first-day discussions and agreements, opportunities to revisit policies.
- Creative means of learning. Examples: Drawing-to-learn (Quillin & Thomas, 2015; Edlund & Balgopal, 2021) and comics (Fink, 2019; 2020a; 2020b).
- Providing social/historical context when reading and interpreting STEM texts.

- Building awareness of power dynamics within STEM fields and classrooms; naming oppressive structures and working to change them.
- Engaging student agency through student-led discussions. Example: Students bring in a course-related item (ad, news article, etc.) and may lead a class discussion.
- Valuing quality of interpersonal relationships within STEM classrooms, labs, and in application of STEM knowledge.
- Moving toward universal accessibility. Examples: Accessible testing formats appropriate to the course (accounting for topic and size), assignments that focus on understanding, flexible due dates, multiple modes for demonstrating learning.
- Instructor feedback and grading on early assignments that encourage consistent, original engagement and avoid punitive strategies (see Newell-Caito, this collection).
- Meeting material needs of students and their communities. Example: Advocating for higher education funding through federal, state, and campus mechanisms.

These practices may be risky. They are difficult to standardize and align with traditional (banking) rubrics of academic or career achievement. Instructors using these methods also encounter risk and discomfort in sharing control of the classroom. Nevertheless, all classroom participants may benefit from pedagogical methods that enhance the agency of students and engage their intrinsic creativity, interest, and ability to build relationships.

Teaching neuroethics during the COVID-19 pandemic, above all, highlighted the importance of compassion, particularly in an atmosphere that pushes productivity amidst widespread death and suffering. Students and instructor alike worked to name what was happening and to articulate pressing moral problems and mental distress arising from the crisis. Because students with marginalized identities (lower-income students, disabled students, students of color, and LGBTQIA+ students) are more heavily impacted, academic spaces that can adequately serve these students gained even greater importance (e.g., Gilbert et al., 2021). Students in the neuroethics classroom engaged compassionately in a way that is too often inaccessible in the sciences.

Humility is warranted when making claims to liberatory practice within Western educational institutions. Practitioners must decide how and when they will resist oppressive practices around them, knowing that this also, inevitably, involves risk. Additionally, academia abounds with buzzwords that deflect from needed radical restructurings; this requires that teachers and students take stock of efforts that operate on tokenism or serve a public relations purpose. Practitioners must confront their limits and the ongoing tension between their liberatory aspirations and institutional inertia; this, too, is praxis.

As educators, it is crucial to hold the hope that any class can erupt in moments of transformation and connection, even within imperfect classrooms and history-bound institutions. And it is important to think beyond the institution. Liberatory theory and praxis in STEM fields cannot be confined to a single classroom or the goals of academic career advancement. Instead, the success of liberatory pedagogy can be observed by the extent to which students and teachers can make sense of the wider world and act on it and with it. Through such joint action, they might come to enact humanizing narratives and technologies within and beyond states of crisis.

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Appendix A: Examples of Assignment Prompts for Undergraduate Neuroethics Course

"Neurobiological definitions of mental health and illness" (an earlier writing assignment)

This week's readings ask us to consider neurobiological definitions of mental health and illness. You will identify some important ethical questions relating to the personal, social, and clinical implications of such biological definitions. Address the following:

1. **Start with an introductory paragraph.**
2. **Consider the three papers and briefly describe:**
    - What is the primary problem that each set of author(s) raises (i.e., why have they written the article)?
    - What is / are the main argument(s) or prescription(s) offered in each paper?
3. **Provide your analysis and reflect on the papers:**
    - What seems to be the scholarly background of the author(s) of each paper? Reflect on how the authors' field of expertise shapes their questions and conclusions.
    - After reading these papers, what do you think is (at least one) potential harm and (at least one) potential benefit of using neuroscience-based information to define mental health and illness? *Be specific.*
    - What recommendations do you have for the responsible use of such information? Name the ethical principles that lead you to argue for these recommendations.

"Neuroethics of education and child development" (an earlier graphic / comics assignment)

The readings for this week explore how neuroscience and technology can specifically impact the lives of children, adolescents, and young adults. You may also see recurring themes from earlier course material. This time, you will draw your responses to the readings. In this assignment, we have the chance to think about these topics creatively.

1. **The authors discuss "raising children" versus "designing children":**
   - Draw what you think "raising children" looks like.
   - Draw what you think "designing children" looks like.
2. **Illustrate an ethical concern that you have regarding neuroscience-based educational interventions.**

"Neuroethics of gender, sex, sexuality, and love" (late in semester assignment):

YOUR CHOICE! You can submit a written reflection or a graphic reflection. Aim for 2-4 pages regardless of format.

1. **Describe the primary ethical concern raised by Fine (2012) regarding the interaction of neuroscience research with "gender" and "sex."**
   - Here, address: What is "gender"? How does "gender" relate to "sex"?
   - **What is "love"?**
   - Can love ever be seen as an illness? Illustrate or explain your answer.
2. **What is "sexuality"?**
   - How might "sexuality" interact with definitions of "love" and/or "gender"?

Appendix B: Pre-Course Online Teaching and Learning Survey

Welcome to [Course Name]! I am looking forward to getting to know each of you in our (virtual) classroom. Before we start this course, I hope that you will take a few minutes to complete this survey. Your answers will be kept private - I do not share them with anybody else - and this questionnaire can help me to learn more about your interests as well as your learning and accessibility needs.

Item 1: What is your full name? You can also let me know here if your chosen name is different from your roster name.

Item 2: If you'd like to share your gender pronouns with me, please do:

Item 3: Do you have reliable internet and computer access?

Item 4: Will you be able to participate reliably in class sessions on [days] at the scheduled times? If not, please tell me more.

Item 5: Do you have access to [required software, e.g., … suite]? [*If applicable, provide information about how to obtain software through institution or course site].*

Item 6: Do you have any accessibility concerns regarding course readings or other materials? *[Provide other relevant info here: e.g., "All readings will be provided as PDFs…"].*

Item 7: Do you have any specific concerns or needs regarding online learning [*if virtual]*?

Item 8: Are there any issues that you would like to share with me (e.g., COVID-19 or other illness, work, family responsibilities) that may impact your participation in the class?

Item 9: What will help you to engage successfully with this course?

Item 10: How can this _____ course contribute to your growth as a _____ student? Any topics of special interest?

Item 11: Is there anything else that you would like me to know?