

ARTICLE

Those who can't, teach: critical science literacy as a queer science of failure

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Abstract

In this paper, I argue that those of us who have left the Sciences proper and moved to feminist studies spaces have continued to do science through our teaching. In a moment when the impulse to do real science is palpitating in our feminist hearts, I suggest that we critically examine the political stakes of our affective attachments and detachments from s/Science(s). I consider what it means to be attached to a Science that earned its epistemic authority through its co-constitution with colonization and slavery. I argue that passion for science may act to strengthen the relationship between Science and Truth and conversely, willful refusal and failure may be used to break the bond. I offer critical science literacy as a practice that can directly challenge the epistemic authority of Science and be read as "doing science" or more broadly as "rewriting knowledge."

*“We contend that feminist thought can do more than offer us resources for the sciences, rather, we wish to demonstrate that sometimes feminist thought *is* science.”*

—*Banu Subramaniam and Angela Willey (2016)*

“We should be asking the question, asking ourselves, about the aspiration to power that is inherent in the claim to being a science.”

—*Michel Foucault, Society Must Be Defended (2003)*

“Under certain circumstances failing, losing, forgetting, unmaking, undoing, unbecoming, not knowing may in fact offer more creative, more cooperative, more surprising ways of being in the world.”

—*Judith Halberstam, The Queer Art of Failure (2011)*

For decades, feminist science studies (FSS) scholars have debated the possibilities of doing feminist science (Giordano, 2014; Longino, 1990; Roy, 2004; Spanier, 1986). One site of interest for these conversations has the “feminist scientist,” that is, the self-identified feminist who is trained as a scientist. Here, I turn to this subject-figure but instead of looking for ways to keep the feminist scientist in the traditional science laboratory, I focus on those who have left the sciences proper and found new interdisciplinary homes in feminist studies. I bring together Banu Subramaniam’s (2009) rethinking of the leaky pipeline metaphor with Judith Halberstam’s (2011) queer art of failure and Sarah Ahmed’s (2014) reading of willfulness to rethink how those of us who “failed” at Science proper have found ways to produce new kinds of science through our teaching in feminist studies classrooms. I read this kind of “failure” as useful for challenging Science’s epistemic authority while also producing new kinds of science. I use this formulation to offer ways of doing feminist science cognizant of critiques of its epistemic authority. Indeed, “failure” at Science might disrupt that bind by opening up possibilities of practicing feminist critical science literacy as doing science itself.

The CFP for this special issue proposes that feminist thought itself *is* sometimes science. I argue that we must carefully analyze why we might want to make such a claim. Simply using a lowercase *s* and

pluralizing “science” does not resolve its relation to the epistemic authority established by capital S Science from its colonial foundation. That is, I argue that the use of lower case plural “sciences” in part remains attached to that epistemic authority. Although we may on occasion want to exploit those benefits, if we do not critically examine our relationship to such privilege, we risk reifying it.

In the second epigraph, Michel Foucault argues that any theory (using Marxism as his example) trying to claim the title of “science” must carefully analyze what kind of knowledge and whose knowledge it is trying to delegitimize. He argues that we must be aware of the dangers that come with attempting to benefit from “the power-effects that the West has, ever since the Middle Ages, ascribed to a science and reserved for those who speak a scientific discourse” (Foucault, 2003, p. 10). Here it is important that Foucault locates the beginning of this epistemic authority in the beginning of Western colonization. Sylvia Wynter (2003) draws on Foucault and Anibal Quijano’s conceptions of power to explain that the colonial and capitalist roots and development of the sciences have produced “man,” thoroughly embedded in a racial hierarchy, through what she calls the “Coloniality of Being/Power/Truth/Freedom.”

We can read Foucault and Wynter together to understand that claiming inclusion in science risks strengthening and relying on a colonial and racialized form of power that is produced by and produces the possibilities for knowledge and life itself. These genealogies demonstrate the co-construction of Science with the globalization of racial hierarchy, both of which together naturalize and justify domination through acts of genocide, slavery, and other forms of exploitation. At the root of the justification for social inequality then is Western science (together with philosophy and other modern disciplines). By producing the categories of human/nonhuman as forms of natural (yet flexible) racial difference, capitalism becomes justified as a natural (yet flexible) economic system (Melamed, 2015). I begin from this understanding of s/Science as always political and implicated in these histories of exploitation. That is, the goal of science is not the innocent goal of “understanding nature” but rather a

political project of producing “nature.” The question I raise in this article is how to keep central the political justifications and potential consequences of working towards feminist sciences.

In this article, I analyze our affective relationships to science. I suggest that the ways we describe science and our feelings about it can reinforce or destabilize the epistemic authority usually conferred upon it. I end with a focus on critical science literacy as one example of how “failing” at doing science research proper may be seen as a feminist science practice that explicitly unsticks Science from Truth and therefore opens up possibilities to unstick Being/Power/Truth/Freedom from Coloniality. I argue that critical science literacy can be seen as a practice in “rewriting knowledge” (Wynter, 1984, 1994). I use literacy to mean the ability to both read and write (produce). I use critical (as in feminist) to signal the “re”-writing of science through the practice of this kind of literacy. I offer this as a “failure,” as a rejection of capital S Science, maybe even an anti-Science, a willful refusal, perhaps the heretical turn we need to disrupt the epistemic authority of Science (that is, the assumption that science = truth).

Affect—specifically passion, desire, and fear—policing the bounds of proper science and the questions appropriate to it. I suggest here that a big part of our desire to engage with science is our desire to prove that we (women and feminists) *can* do it. I explore the importance of proving that we can do science at the same time as I examine the possibilities of embracing a *can't-do* attitude toward science.

Sara Ahmed (2004) argues that emotions are political, not simply individual psychic truths, and that emotions “do things.” She introduces the idea of affect as “sticky” in her analysis of how happiness is used to maintain the assumption of the family as a social good. She argues that “affect is what sticks, or what sustains or preserves the connection between ideas, values, and objects” (p. 29). Rehearsing happiness as the appropriate affective response to the family creates a stronger attachment between the family and social good through what she calls “affective economies.” To succeed in this economy of happiness, then, is

to be happy about the family and participate in circulating more happiness through love of your family and/or the idea of the family. Ahmed argues that when one is unhappy about the family, they are seen as the problem—the source of unhappiness for all. However, she also posits that we might analyze unhappiness to show that the family is not necessarily a social good. In this way, unhappiness might be able to unstick this relationship. She labels those who disturb these attachments as “affect aliens” or “feminist killjoys.”

For the Love of Science: We Can Do It!

In recent years, we have seen a growth in feminist science studies faculty positions and curricular innovations in feminist and women’s studies departments. As a feminist studies professor trained as a scientist, this has been good news. I noticed something of interest in recent years as I have interviewed, worked, attended conferences, and retrained in feminist studies. My humanities- and social science-trained colleagues are not just impressed by my science credentials but often explicitly interested in hearing the “real” scientific details of my research. As I have worked in feminist circles, I have noted that when giving talks I am assured that “we can understand it [science]” and asked to share more graphs and data so that my colleagues might engage with the science of my work. In some ways this marks an exciting shift in women’s studies. Feminist scientists have much lamented that our colleagues sometimes act as if there is no way that they can understand science or technology (Fausto-Sterling, 1992; Subramaniam, 2005). At the same time, I wonder what is at stake in claiming that we can understand science and how, in such claims, “real” science is being defined.

In an exemplary case, Anne Fausto-Sterling (1992) concludes her notable essay “Building Two-Way Streets: The Case for Feminism and Science” by naming her affection for science and then saying she is not going to spend time on it. She also states that she believes we should be talking about love and pleasure as it relates to science. Fausto-Sterling lets us know that she takes great “pleasure from observing the natural world” and is “distressed” (p. 347) to see students not care about the physical world. I agree we should be (carefully) discussing our affective relationships to science, nature, and our physical worlds. By introducing this side note about her love of science but not exploring it in detail, this affective claim is left as evidence of a certain kind of unexamined truth about a natural draw to science. As a highly influential treatise on FSS,

this casual mention of science-loving naturalizes this discourse for the field.

Drawing on Ahmed (2004), I explore here what work “passion for science” does in feminist communities. Enthusiasm for science is an important feature of popular understandings of who is capable of doing science in this moment. Therefore, showing passion towards science individually and collectively as feminists is part of showing that we have the aptitude to do science. But who can do science? In the latter part of the twentieth century, we see a move away from the figure of the dispassionate scientist to one that “could be celebrated as passionate, motivated, socially networked, energetic, and creative—virtues of entrepreneurialism” (Murphy, 2012, p. 71). Today, the popular image of the scientist (inevitably white and male) has become a fun, nerdy, brainy subject who is passionate about data, numbers, and problem solving through science while simultaneously remaining socially unaccountable (Willey & Subramaniam, 2017). Indeed, as I have argued previously, the passion to do science acts as a colorblind and gender-blind correction to discriminatory assumptions of natural aptitude (Giordano, 2017). However, the idea of a natural predisposition has always gone hand-in-hand with having the passion to do science (Willey & Subramaniam, 2017). Just as feminists may question the political utility of arguing that women are as smart as men, instead of challenging the idea of intelligence itself, I argue here that we as feminists may have fallen into the same trap with passion for science. The many stories of budding feminist scientific passions squashed by sexist teachers, parents, or the “system” are repeatedly invoked to explain the underrepresentation of women in science careers. Feminists must do more than show that we too have this passion for science and instead question more deeply what this passion is, how is it produced, how it operates, and what it means that it is directed towards this object called science.

Feminist scientists who have moved to feminist studies programs from the sciences can play a particular role in telling stories about how and why we left the sciences proper. Even those of us who succeeded to the point of receiving PhDs in the sciences, thereby forever holding paper rights to the title “scientist,” but who do not continue to practice science are part of the statistics of women who leaked out of the pipeline.

Many of us begin with stories of passion and love for science and discovery of our natural and physical worlds (Clarke, 2001; Fausto-Sterling, 1992; Fox Keller, 1977; Weasel, 2001). Reading narratives of feminist scientists’ complicated love affairs with science may help us to understand more about the political meaning of our affection. For example, Evelyn Hammonds, now a historian of science who began her PhD training in physics, responds to Aimee Sands in the often-taught

interview published as “Never Meant to Survive: A Black Woman’s Journey” (Hammonds & Sands, 1993) by saying that she always liked science and wanted to do more after being exposed to doing science on her own through a chemistry set that her father bought her when she was a child . However, she also says that she had an interest in doing as much science and math as possible because she knew that would help her get into a “good college” (p. 208). Science’s deep imbrications in networks of power make it impossible to tease out a pure love or passion for scientific discovery outside of the desire for access to power. Hammonds retells the story of how during what was supposed to be a “fun” summer math program, she and the two other black students were not having fun because they were not able to keep up due to differences in previous education compared to the white students. This is an example of how passion and exhibiting a desire to do science cannot be considered separate from the ways racism, sexism, and other systems of power differently educate and expose people to what are considered the proper objects and backgrounds in science. Ruth Hubbard further points out that taking pleasure in observing our “natural world” is class- and race-based, as many people grow up without “nature” around them (Hubbard et al., 1993).

I have argued here that feminists circulate stories about having childhood passions for science to disrupt the idea that the numbers of boys and girls in science reflect their natural aptitude or interests. But a careful political analysis of our passions also reveals the danger in relying on a naturalized idea of passion rather than investigating the epistemic power of science. I wonder if we risk reifying the idea that science is the best truth-telling method. That is, do we read all desires to investigate the world around us, our bodies, and our communities as scientific passion? Drawing on Hubbard et al. (1993), I ask, when other options for truth-telling are available, what choices could we make? How might we think about the ways that we continued those passions for discovery without proper science? How might we strategically and ethically develop our feminist scientific passions? As I move towards offering some answers to these questions, I suggest we explore the possibility that we *can’t* do science.

We Can’t do Science: Reading Ignorance, Fear and Failure as Willful Resistance

If we read our reasons for loving science as more complicated than evidence of our innate attraction to the field, what might fear, hatred, or mistrust of science, or even scientific illiteracy and ignorance of scientific

facts, mean? Now that I have explored and critiqued claims that we can do science, I turn my attention to reasons why we can't do science. I look at ways that we can't in two senses: first, being unwilling to, and second, having been stopped from pursuing our scientific dreams. I continue with my argument from the last section about the unequal power between science and feminism and explore what some uncommon forms of resistance to that power imbalance might look like.

In the last section, I read the relationship between science and passion or love for science through Ahmed's concept of sticky affect to argue that passion and love for science attach science to truth. I argue that the absence of that "proper" affective relationship to science, through hate, disinterest, and willful refusal, may detach science from truth (similarly to how unhappiness may unstick the family from the social good).

Fear and ignorance of science are often cited as the primary ways in which women's studies contributes to the impossibility of feminist sciences. Where individuals express an anti-science position as a political response, there is often contempt for it. For example, in discussing the importance of a scientifically literate feminist studies, Fausto-Sterling (1992) shares that "at the extreme (but not particularly uncommon) are students who view a refusal of scientific knowledge as an appropriate political stance. To say I find such attitudes distressing is to vastly understate my feelings on the matter" (p. 338). She continues: "I often experience my students' refusal to explore certain aspects of human knowledge as a willful anti-intellectualism" (p. 339).

Feminist science studies scholar Banu Subramaniam also uses "willful" to describe the pattern of her women's studies colleagues' refusal to be scientifically literate. She describes a colleague coming to her office to ask about breast milk production as an example. She continues to express frustration at the entire field's ignorance of science as a systematic "willful refusal to be scientifically and technologically literate" (2005, p. 235). The example of asking a evolutionary biologist who studied plants about breast milk shows us not only a misunderstanding of how science works but an assumption that scientists know about everything having to do with science and health—a good example of "reverent disdain" (Willey & Subramaniam, 2017). I am not as interested in teasing out the specifics of this illiteracy problem here, but I will note the significance of an intentional, willful refusal to engage with science. What might a willful refusal offer? I suggest we have focused more on how it does not serve feminism than how this refusal might also serve the goals of feminist science.

The willfulness that Fausto-Sterling and Subramaniam lament might be read instead as an important, political resistance to science.

Ahmed (2014) argues for the political value of willfulness, producing a willfulness archive of how this charge has been made against those who threaten the social order or who are disobedient, as a way to dismiss and/or discipline them. Therefore, her popular feminist killjoy figure may be read as a politically willful subject. Although she cautions us that not all acts of self-proclaimed willfulness are politically righteous, she does give us a reason to pause before denouncing and dismissing an act as willful.

A common metaphor used to discuss feminism and science is that of two cultures (Subramaniam, 2005). If we consider the power differences between different cultures, we might see how a non-English speaker living in an English-speaking country and refusing to speak or learn English may be read as a political act of willful refusal against cultural imperialism. To be illiterate in this case might be an important act of resistance. How might we use this analogy to think about scientific illiteracy? In Jean Barr and Lynda Birke's (1998) work on women and adult science education, they describe what is commonly seen as "ignorance" of science as potentially resistant. Barr and Birke found that sometimes the women they interviewed chose non-scientific explanations to describe the "natural" world even though they knew the scientific ones. They also point out that Emily Martin (2001) has similarly argued that what might at first appear as scientific illiteracy among working class women was actually a resistance to medical authority on the subject of menstruation. Therefore, Barr and Birke (1994) argue that women are not just "alienated" from science, but also actively resist science.

Next I explore some of the reasons why we might need or want to resist the power of science. Both Ruth Hubbard, a trained biologist and the first woman tenured in biology at Harvard University, and feminist philosopher Sandra Harding respond to Fausto-Sterling's "Building Two-Way Streets" essay by taking issue with the way Fausto-Sterling talks about women's chosen ignorance about science (Hubbard et al., 1993). Hubbard argues that she is also concerned that feminists do not know enough about science but explains this as a consequence of women's exclusion. She points to the systematic ways that those disenfranchised are kept ignorant about science and kept away from its epistemic power (p. 45-48). Sandra Harding demonstrates the deep historical roots of this exclusion and makes a call for us to interrogate those legacies for Western sciences (p. 49-55). These points are relevant to how we judge scientific illiteracy by feminists or by populations that have been systemically harmed and/or kept out of science. They are also important to how we move forward in engaging with science.

It is vitally important to remember that many of us were unable to do science because it we were denied full access. Feminist studies

scholars who were trained as scientists have documented how we were unable to do science in proper science spaces because of direct discrimination or because we asked questions that were inappropriate for science spaces (Fox-Keller, 1977; Roy, 2004; Giordano, 2014). Hubbard et al. (1993) discuss the ways that once you start to analyze science itself and ask questions, you are not welcome.

This points to a problem. We *can't* do science the way we need to once we begin to be exposed to feminist critiques of science. There are systematic ways that we are stopped from pursuing feminist science questions and feminist methodologies.

Toward a Queer Science of Failure: Embracing Science Literacy and Illiteracy in the *Undoing of Science and Doing of New Queer Sciences*

In *The Queer Art of Failure*, Judith Halberstam argues that “Under certain circumstances failing, losing, forgetting, unmaking, undoing, unbecoming, not knowing may in fact offer more creative, more cooperative, more surprising ways of being in the world” (2011, pp. 2–3). I draw on this idea to propose a queer science of failure that is focused on the ways that failing, unmaking, undoing, and not knowing science may lead to a more just world.

I use the word queer to suggest not only a challenge to capitalism but also a challenge to the categories of human/nonhuman and normal/abnormal that science has enforced and drawn on for success. Halberstam argues that we can read a history of successes and failures under capitalism in multiple ways and suggests reading the history of failures as “a tale of anticapitalist, queer struggle” (2011, p. 88). However, drawing on Foucault’s (1976) earlier example of Marxism, we must remember that a new anti-capitalist science in and of itself will not necessarily “unsettle” (Wynter, 2003) colonial, racial, and gendered power. I find usefulness in Wynter’s emphasis on not only the Coloniality of Power but also the merging of Being/Power/Truth/Freedom because what is at stake in unsettling coloniality is the definition of the human itself. This point is an important place of shared concern between feminist science studies and decolonial and postcolonial studies (Pollock & Subramaniam, 2016). I read Wynter’s call for a new science (2003) to produce a new descriptive statement of the human as similar to the stated purposes of this special issue to read feminism as “doing science.” However, I suggest we hesitate before embracing the term “science” and go back to Wynter’s (1984) earlier calls for “rewriting knowledge.” This new science/rewriting of knowledge is about undoing the disciplinary boundaries and truth that produce “narratively

condemned status[es]” of Others/nonhuman humans (Wynter, 1994). It is also about “unsettling” the relationships between Being, Power, Truth, and Freedom that were stuck together through processes of colonization (Wynter, 2003).

What can we gain from reading feminist scientific “failures” differently? In critiquing the much-used metaphor of a science pipeline, Banu Subramaniam (2009) questions our obsession with plugging the leaks and wonders whether the metaphor of the pipe itself may be the problem. She asks whether a reorientation to the metaphor might have us celebrating escape from the pipe instead. Birke also critiques the practice of using scientific education to make people fit better into a science that is not meeting our needs: “Many people perceive things to be not quite right in the science camp, while scientists and educationalists are wondering how to persuade more people to pitch tents there” (1991, p. 17).

Reading this together with Halberstam’s (2011) queer art of failure, we might ask, have feminist scientist “defectors”¹ left the science camp, broken out of the pipeline and produced a “queer science of failure” that we should celebrate? And if so, then how should we read desires and calls for laboratories of our own so that we do not simply continue building that same pipeline through new territories, colonizing more area by pitching science tents? I argue that if we focus on the political consequences of our arguments we can use them to say we need laboratories of our own to fulfill our passions to produce knowledges about our worlds and bodies. This would mean broadening science rather than simply gaining inclusion in science as it is.

In Defense of Scientific Illiteracy, and Unknowing Science

Independent artist, filmmaker, and activist Lucía Egaña Rojas writes in “Notes on a Transfeminist Technology” (2013) that “A transfeminist technology will value illiteracy for its improductiveness for industry, as a way of finding paths unimagined by speed and productivity.” Rojas advocates creating new worlds by being gender illiterate and acknowledging how the positive relationship between epistemic power/authority and literacy devalues the knowledge of many of the world’s poorest inhabitants. I draw on Rojas’s exploration of illiteracy before I delve into an argument for critical science literacy to leave space open for the importance of scientific illiteracy as a failure that threatens the supremacy of scientific knowledges. Although it is not the goal of this article, I hope this opens up questions about what kinds of scientific illiteracy we might embrace to destabilize science and remake knowledge

production.

Decolonial activists in South Africa who were part of the Fees Must Fall movement (that stemmed from the Rhodes Must Fall movement) came under intense fire when some suggested a total abolishment of science was necessary to remake new sciences. A video of one activist speaking at a university event about science went viral in October 2016 with the hashtag #ScienceMustFall. The online commentaries showed how attacks on science were used to delegitimize the activists' movement. The activist's description of science as a colonial project that needed to be abandoned was not just rejected but taken as evidence of ignorance. Yet, the activist also mentioned in her brief comments that she was once a science student and suggested that it is because of the boundaries of what counts as real science that she did not continue in the sciences. She is another one of the science failures that I suggest we listen to and engage with as we rethink feminist engagement with science. My point here is to foreground what might be called an anti-science approach to creating new knowledges before I move into reclaiming science teaching as science, to argue for undoing and unknowing science—failing at science.

“Those Who Can, Do. Those Who Can’t, Teach”: Teaching Critical Science Literacy

Here I come back to those of us trained as scientists who have ultimately failed to continue in science proper. I use these case studies to develop the idea of teaching critical science literacy as part of a queer science of failure. I use “queer science of failure” to attach science to both “queer” and “failure” and claim the practices I outline below as knowledge production activities themselves, as always political, and always challenging capital S Science. Many of us defectors are not able to return to lab bench science for the reasons mentioned above. However, I posit here that we continue to engage in science through our teaching. We might further read the popular saying meant to devalue teachers through Ahmed's (2014) work on willing and willful subjects. The failure to “do” science then might be seen as a willful political gesture against a science that reproduces injustices. I argue that the defectors among us *can't* do it any longer. We often try to stay in the sciences and make change from within. At some point, however, we realize the limits of our work from within as feminist spies.² When being feminist spies is not enough, we have to imagine other ways of becoming knowledge producers. I argue that many of us, when we just *can't* take it any longer, turn to teaching critical science studies, thus creating our own feminist science labs in

women's studies classrooms. And by turning to teaching, specifically teaching in women's studies, we not only fail at being a part of science proper but also fail at capitalism. Halberstam's goal in *The Queer Art of Failure* is to use examples of art "to think about ways of being and knowing that stand outside of conventional understandings of success," arguing "that success in a heteronormative, capitalist society equates too easily to specific forms of reproductive maturity combined with wealth accumulation" (2011, p. 2). We defect and choose to take lower-paying jobs, devalued in not only economic terms but in social status and power. Perhaps claiming that we choose this route of failure (teaching) is giving too much agency to us without acknowledging the historic ways that people of color and women are overrepresented in these underpaid professions. As I point out in the previous section, many of us can't do science because we are systematically kept out of the practice. While acknowledging this, here I collapse these reasons for not being able to do science into one failure to examine. I suggest we pause to embrace this queer failure. This failure might lead us to undo science through our teaching of critical science literacy or "und" the legitimacy of science as a neutral method or set of disciplines that can be compatible with feminism/feminists. At the same time, I argue that through this kind of teaching and delegitimizing of science, we create new definitions of science—ones that are politically grounded in social justice and the politics of location—so we are therefore also "doing" or creating new sciences (lower case, plural).

Subramaniam (2005) asks "What would it mean for women's studies to engage with the sciences as its own? Not at arms length, not with fear, not with paranoia, but owning it as ours to shape, to empower? What would it mean for us to have laboratories of our own?" (p. 238). To answer this question, first, I argue that we need to acknowledge that the reasons people fear of science are real and not paranoid delusions of potential harm. I also like the idea of owning science as our own. How might we then move forward in utilizing science, then, while holding on to why we *should* be fearful and so as to not reify unjust power?

Here I outline how we can move forward with an ethical and politically strategic engagement with science through critical science literacy. There are two parts to this. First, we must undo science by expanding access to a kind of knowledge that is traditionally kept out of the hands of marginalized groups so that we might better critique the epistemic authority of science. Second, we must do new sciences by expanding or changing the definition of science to include our pedagogical approaches as part of "doing science." Throughout, it is important that we leave space for resistance through non-engagement so

that we are not positioning ourselves in opposition to those willfully resisting engaging science through illiteracy. We must instead understand the importance of multiple strategies of resistance.

I posit there is a disjuncture between what we are saying and doing. We keep saying we need to do science. But what if we stop and see what we are already doing? We can be politically strategic about how we redistribute power—particularly epistemic privilege—through our feminist critiques of science and critical science literacy work. Nearly all science-trained feminists have published on education or pedagogy in some form since leaving the sciences (including Barad, Birke, Fausto-Sterling, Hubbard, Roy, Weasel, Whatley, and myself). If we give up on the metaphors of two-way streets and two parallel worlds that each need to equally change and instead take up the idea of science and feminism as an unequal pairing, with science occupying a privileged place, we might go back to feminist antiracist politics instead. Coming from this position we might see our role as feminists trained in the sciences as helping to teach critical science literacy skills based on our first-hand knowledge of the sciences. And through this understanding we might take this parallel further and find a more liberatory science laboratory practice focused on redefining sciences both inside and outside the academy.

This brings me to the first part of my proposal for a politically just, critical science literacy project: our teaching is about producing new scientific knowledges. Many of us science- and non-science-trained women's studies professors may be teaching and engaging with science without realizing it. For example, as part of the National Science Foundation (NSF)-funded two-way streets project, Bates college faculty (Baker, Shulman, & Tobin, 2001) found that women's studies faculty at first saw science as something that needed to come from outside their classes and research. However, they found to the surprise of organizers and faculty participants that the feminist studies faculty were able to produce critical science studies curriculum from science that they were already engaging with in their teaching and research. That is, there was an assumption shared by the feminist scholars that they did not really do science or understand science.

I am making a claim here that critical science literacy is not simply learning how to read or engage with science but is doing science itself. To make this claim, I use feminist science studies and a basic definition of literacy to define the terms "science" and "literacy." I begin by going back to the foundational science studies tenet that all scientific knowledge is socially situated. That is, science is not ever simply produced in scientific laboratories.³ Feminist philosopher Helen Longino (1990) uses this principle to argue that we cannot have feminist science

until we make culture itself feminist. I suggest here that we read critical engagement with science as a more direct form of intentional scientific knowledge making. The second definition we must understand is that of “literacy.” Literacy is not simply the act of reading but is defined by the ability to write. Although basic science literacy is usually taught as a way for the public to engage in science believing rather than science making, feminist critical science literacy is part of a tradition of producing responsible scientific actors across disciplines (Giordano, 2017). Why do we see science literacy as simply reading or understanding science rather than the ability to write it? In this case, I identify critical science literacy as re-writing scientific knowledge.

The idea of broadening the responsible actors of science is popular among feminist science studies scholars. For example, in Karen Barad’s (2001) work on agential literacy she explains that one of her courses “was designed to enable students to learn science while thinking about science, and to learn that thinking about science is part of doing science” (p. 240). Similarly, in *Common Science* Barr and Birke (1998) define a critical science education as one that broadens our definition of those responsible for and those who should take part in science: “A critical science education would, in consequence, involve working with women’s groups in the community, drawing on their own agendas, whether to do with housing, health, roads or the environment, in an effort to develop more broadly based ‘scientific communities.’ The kind of science education we envisage here is an aspect of citizenship education of ‘pedagogy through politics’ rather than a pedagogy centered solely on the classroom” (p. 136). The point here is that science education, which I argue is science making, is not simply about discovering truths but instead is about producing politically and socially directed knowledge—knowledge that is about intentionally redefining ourselves, the human, and our world.

This brings me to my second point, which is that we must carefully define the need for science literacy. I argue that we should see it as producing knowledge about our worlds and bodies through a redistribution of epistemic authority. A queer science of failure that is based in science literacy would allow us to challenge old knowledges and create new knowledges.

One way to question Science is to critique the philosophical aspects of the field. Another is to learn to read science and critique the methods and results of specific studies (Whatley, 1986; Barr & Birke, 1994). In part, science maintains a special status because its products are not accessible to a wide range of people. There are physical barriers to finding science articles as well as linguistic barriers to reading science writing. One practical and useful role for science studies scholars,

especially those trained as scientists, is to make it possible for more people to understand scientific practice and writing. Once again, this is not a new idea. Here we might want to think about returning to teaching and critique as queer failure at producing the “new.”

Whatley (1986) argues that “what is more crucial than just supplying more accurate information to use as ammunition in debates is to help students develop alternative hypotheses, to see the roles social, cultural, and political factors can play in what appear at first to be biological issues” (pp. 186-187). She gives examples of how this can be incorporated into physical education classes to help students develop an understanding of physical ability, hormones, strength, and the social aspects that co-produce each of these concepts. More recently, Deboleena Roy’s (2012) detailed methodology for reading and engaging with science was included in a handbook for feminist methodologies.

In my own teaching and research I have developed a kind of critical science literacy practice (Giordano, 2017). My students learn about the process of how science moves from the laboratory to publication, how to track down the primary science publications that popular news report on in brevity, and how to apply feminist critiques of science to understand and engage with scientific results. In upper-level classes, students draw on these skills while bringing together a wide variety of knowledge sources to collaboratively produce zines about science and health topics. This practice has produced organic engagements with science. For example, in one semester students used the skills developed in the course to produce a strategic collective response to anti-immigrant population control environmentalism propaganda that was circulating on campus and in the larger community around Earth Day. In this case, the relationships between who counts as “human” and how scientific discourses are mobilized in environmental discourse to control the movement of bodies and capital was clear. In this way, queer critiques of science allowed the students to challenge racist, anti-immigrant arguments, thereby producing new knowledge about our bodies and worlds.

I argue that each of these examples illustrates not simply reading and critiquing science but important engagements and the doing of science in women’s studies classrooms. I argue for a queer science of failure in which we revalue teaching and education and redefine science as not simply what is done in proper wet labs. Although I have focused on those of us with science PhDs in this article, I conclude by suggesting we consider counting all of us as “failures”—including those of us who dropped out of the pipeline in elementary school, those of us who never found our way to the pipeline to begin with, and those of us who had to hack our way out later downstream. This means that we must make room

in feminist spaces for those without science PhDs to be legitimate critical science literacy educators and producers of scientific knowledge. Critical science literacy and teaching is but one form of many possibilities for new sciences. I suggest we embrace an irreverent disdain for traditional science and instead practice feminist science by always keeping central the epistemic power that we are challenging, using, and risk reifying through our claims to “do science.” I encourage others to build their own archives of queer sciences of failure. What might willful resistance look like within and outside of feminist classrooms? How might we create space in these times for a much needed anti-science, antiracist, feminist approach to knowledge production?

Notes

¹ Those of us who left the sciences proper do not universally embrace the term defector.

² Deboleena Roy (2004) uses the term “feminist spy” in passing to describe the challenge of being a feminist pursuing her PhD in the natural sciences.

³ Also, much of the work done by scientists in proper science spaces is not conducted in laboratories either. Lead researchers spend much of their time writing grants and journal articles and supervising student workers and laboratory assistants, rather than working directly with hands-on experimentation.

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Bio

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