

STS as Critical Pedagogy: Bridging the Gap Between STS Scholarship and Pedagogy

Introduction

Pedagogical interventions are key sites of knowledge production (Downey, 2008; Lenoir, 1997; Levinson, Foley, and Holland, 1996; Traweek 1988; York, 2015), and therefore should be recognized as central to the field of STS (Science, Technology, and Society). STS pedagogies in particular can be understood within the methodological framework of critical participation, or reflexive interventions in which knowledge is co-produced (Downey and Zuiderant-Jerak, 2017; Lezaun et al., 2017; York, 2018). This grant will support a workshop that brings together STS scholar-teachers to foreground pedagogy as a legitimate area of STS inquiry and to develop the subfield of STS as Critical Pedagogy. The purpose of this workshop is to forge a strong community of STS scholars focused on STS as critical pedagogy, and to elevate pedagogical interventions as key sites for STS inquiry, scholarship, and engagement. This workshop will facilitate the development of a community of practice to investigate tools, methods, approaches, and theories related to STS as critical pedagogy.

One way of conceptualizing STS engagement is in terms of ‘experiments in participation,’ or projects that ‘formulate, enact, and reflexively learn from novel, STS-inspired practices within their fields of study’ (Downey and Zuiderent-Jerak 2017, p. 239). These experiments can also be understood as ‘critical participation’ because the STS researcher engages interlocutors in a mode of collaborative knowledge production that maintains a critical perspective but also welcomes mutual learning through the engagement. STS research in this mode has engaged a variety of domains, from the laboratory to the public museum (Downey and Zuiderent-Jerak, 2017). We propose to apply this theoretical orientation to the domain of pedagogy in order to conceptualize teaching as a mode of critical participation in its possibilities for intervention and collaborative knowledge production. In doing so, we also posit that the pedagogical site, such as an undergraduate classroom, is an interesting space for research on STS-inflected pedagogies as well as research that innovates and develops STS theories and methods.

The notion of critical pedagogy emerges from the work of Paulo Freire (2018), who recognized pedagogy as inherently connected to politics and knowledge production. Sites of undergraduate and graduate teaching and learning provide opportunities for critical participation in STS as critical pedagogy--sites where teaching colleagues and students are the interlocutors, and pedagogical interventions present mutual learning opportunities through which the politics of knowledge production are analyzed and challenged. STS pedagogies may be enrolled in helping STS students to understand the discipline sufficiently to further their education or career path, or STEM students to critically reflect on their assumptions about technological progress, or social science and humanities students to interrogate information, media, and knowledge production. Regardless of the specific learning site, there are important pragmatic questions about how to *do* STS pedagogy as a practice informed by critical pedagogies from other

traditions and as one informed by STS theories and methods (Jasanoff, 2017). Moreover, STS as Critical Pedagogy is not only interested in how we teach STS content, but in how our practices and sites of teaching might become the subjects of STS experimentation, intervention, engagement, and research.

To date, while there is abundant literature on engineering education and engineering ethics, some of which engages critical pedagogies and STS perspectives (see, for example, Cech, 2014; Beddoes, 2012; Boudreau, 2015; Downey, 2015; Riley, 2003; Riley et al., 2009) pedagogy has not been a primary focus for STS research. This is evidenced by the relatively few panels focusing on STS and pedagogy at major conferences, such as 4S (Society for Social Studies of Science), and limited publication on this topic. This gap suggests several implicit assumptions: that sites of teaching and learning do not need critical interrogation as sites of knowledge production; that they are generally not valuable sites for research, experimentation, and intervention; and/or that STS pedagogy and STS research are necessarily separate practices in which teaching is merely a way to diffuse that which is understood through research. The latter assumption reflects the much-critiqued , ‘banking’, or transmission model of pedagogy: the expert knows things, and merely needs to transmit this knowledge to the students, who are conceptualized as containers (Freire, 2000). In this model, the classroom is assumed to be blackboxed, tidy, and unmessy.

We propose that we must reflexively turn the mirror inwards, toward our own teaching approaches and assumptions. We must collectively and collaboratively open the black box and challenge the STS community to consider its own assumptions. As teachers, we must consider our own roles as actors in the knowledge production process, to consider the classroom as an experimental space, and to reflect on “experiments between what is and what might be” (Lezuan, Marress, and Tironi, 2017, p. 207).

Moreover, Making and Doing--an increasingly important form of STS practice as evidenced in the Making and Doing sessions at 4S meetings--hinges upon translating STS into active, participatory, and educational opportunities. While the last few 4S conferences have included presentations of some pedagogical intervention, there is little systematic evaluation of how to translate these interventions and what has been deemed successful as critical pedagogy, not just modified STEM education. There has also been a renewed emphasis in “STS in Practice” (there was an ad-hoc committee report in August of last year on this topic, see Rea et al., 2018) that aligns with the 4S mission to recharge the STS diaspora to bridge to other communities of practitioners and educators, even if they aren’t necessarily in academia.

In this workshop we will bring together a community of scholar-teachers to examine pedagogical interventions that demonstrate and reflect on STS as critical pedagogy within educational contexts. These contexts include the undergraduate educational experience, K-12 contexts, public engagement and outreach activities, museum education contexts, and graduate student training. We invite STS educators to share their own experiments in STS as critical pedagogy, reflections on what it means to engage students and the public in STS in meaningful ways, contributions to defining STS as Critical Pedagogy, and analyses of how pedagogical practices

might inform STS theories and methods. In addition to traditional talks, we invite playfully novel forms of interactive presentation, such as teaching demos (worksheets, activities, etc.), interdisciplinary learning experiments and research, and overviews of innovative course syllabi. We welcome collaborative presentations with students.

Objectives

The goals of forging a strong community of STS scholars focused on STS as critical pedagogy, and elevating pedagogical interventions as key sites for STS inquiry and engagement, will be achieved through the following objectives:

Establish Foundations For An Intellectual Community

The objective of developing an intellectual community around a shared interest will be initiated with an in-person two-day workshop that, with NSF support, will also include participants from teaching-oriented institutions (K-12 and college/university) as well as educators embedded within communities, such as museum educators. Throughout the workshop, activities will be organized to maximize discussion and interactive engagement in a supportive and inclusive environment. Protocols for communication (e.g., shared website and listserv) will be established so that participants can continue to easily communicate and share resources, and to expand this intellectual community.

Identify, Assemble, and Share Resources

The workshop will collect and curate an updated set of syllabi to be included in the 4S repository. Because the workshop will include participants from K-12 educational contexts, we will work with the 4S webmaster to have a special section dedicated to K-12 syllabi and activities. The workshop will also curate a collection of classroom case studies and interactive activities and activity templates for deploying STS interventions in a variety of learning contexts that will be made accessible online for public use.

Develop Collaborations and Publications

Workshop activities will include efforts to initiate collaborations on special issues and collaborative publications, with a long-term goal of establishing an edited volume, or handbook, on STS and pedagogy. An additional product from the workshop will include a publicly accessible white paper that maps the scholarship of STS as Critical Pedagogy in addition to accessible summaries of workshop presentations, activities, and discussions.

Intellectual Merit

This workshop will advance knowledge by focusing on STS pedagogical interventions as sites of knowledge production and theoretical inquiry, an area that has historically received less attention from STS scholars.

Bridging the gap between STS scholarship and pedagogy is one promising way to forge an engaged STS. In the introduction to the Fourth Edition of *The Handbook of Science and Technology Studies*, the editors write, “Increasingly, STS also asks, how can our insights be put to work in ways that improve outcomes for people and the planet?” (Felt et al., 2017, 2). This reflects a turn in STS toward engagement, and for many STS scholars this question is operationalized in the classroom where we attempt to work with students to understand and embrace these insights. Yet at the same time, in the context of teaching, a pedagogy that starts with STS insights as a static category of knowledge may betray some of the fundamental insights of STS with regard to knowledge production, disciplinary formation, and the co-production of “epistemic, technological, and social orders” (*ibid*, 1). That is, the assumption that knowledge is fixed, static and ready for dissemination in the classroom potentially ignores STS insights regarding the messiness of knowledge production, the situatedness of knowledge production practices (Haraway, 1988), and the coproduction of knower and that which is known (Barad, 2007).

Moreover, this approach would imply a model of teaching-as-transmission, or a ‘banking model’ of education (Freire, 2000). Paulo Freire, in *Pedagogy of the Oppressed* (2000), framed pedagogy as inherently connected to arrangements of power, politics, and knowledge production. Critical pedagogies forge alternatives to a transmission-of-knowledge model and attend to power dynamics. Within a critical pedagogy framework, traditional modes of knowledge transmission are critiqued and challenged in favor of participatory approaches and “critical-thinking based education” (Mahmoudi et al. 2014, p. 86). Freire’s mentee and colleague, Ira Shore, identified critical pedagogy as

Habits of thought, reading, writing, and speaking which go beneath surface meaning, first impressions, dominant myths, official pronouncements, traditional clichés, received wisdom, and mere opinions, to understand the deep meaning, root causes, social context, ideology, and personal consequences of any action, event, object, process, organization, experience, text, subject matter, policy, mass media, or discourse. (2012, 129)

bell hooks elaborates further in *Teaching to Transgress*, where her own experiences in desegregated schools led her to identify a difference in “education as the practice of freedom and education that merely strives to reinforce domination” (hooks 1994, 4). This approach, like key questions and focuses in STS, centers around critiquing and questioning arrangements of power and authority, and like STS, pushes learners to conscientiously reflect on their own learning processes while questioning, unpacking, and deconstructing the processes of knowledge production and associated contexts. The STS critique of knowledge production as linear, from creation to diffusion to utilization (elaborated on by Downey and Zuiderent-Jerak in their analysis of *Making and Doing*, 2017), parallels critiques of the transmission, or banking, model in teaching, in which the teacher, or “sage on the stage” imparts knowledge on students, who are, in this model, *tabula rasas* or empty vessels awaiting wisdom and knowledge.

This workshop will provide a framework and scaffolding for a bridge between the rich body of work in critical pedagogy and STS. In particular, the workshop will focus inquiry into STS as “participatory experiments” in knowledge production and dissemination within formal and

informal learning contexts. Recent work by Lezuan, Marress, and Tironi (2017, 212) argues that participatory experiments “represent trading zones between different traditions of experimentation.” Thus there is a need to “develop modes of analysis and intervention that distribute the initiative more evenly across diverse and heterogeneous forms of practice” (Lezuan, Marress, and Tironi 2017, 212). To conceptualize pedagogical approaches in terms of participatory experiments is to embrace the co-production of knowledge in the learning context and to recognize that these “heterogeneous forms of practice,” or what Law (2011b) describes as “heterogeneous arrays” can also be understood as “knowing spaces.” Using a lens of critical pedagogy and critical participation situates knowing spaces, and associated knowing methods, as “materially complex and and performative webs of practice that imply particular arrays of subjects, objects, expressions or representations, imaginaries, metaphysical assumptions, normativities, and institutions (47).” That is, the learning context can be a space of making and doing, where STS insights are not merely transmitted but formed and performed - and also made exciting. hooks notes that little work has been done in terms of investigating how the higher education space can be made exciting, and that such excitement can “co-exist and even stimulate serious intellectual and/or academic engagement” (Hooks 2014, 7) How might STS scholar-teachers be poised to “experiment with hybrid knowing spaces” (Law, 2011b, 48) in pedagogically sound and playfully innovative ways? And, how might these practices further inform STS theories and methods?

Broader Impacts

This workshop explicitly focuses on how STS engages teaching and learning with an interest in improving STS pedagogies in formal and informal learning contexts, in generating interest in STS pedagogy as a legitimate site for researching core theoretical and methodological concerns of STS, and, relatedly, in facilitating the stronger development of an STS-Critical Pedagogy community of practice. In achieving objectives connected to these goals, this workshop is likely to contribute to improved STEM education and educator development (because much STS pedagogy is practiced in STEM programs), and increased public scientific literacy and public engagement with science and technology (because much STS pedagogy is practiced in liberal arts and general education curricula as well as in museums and public engagement events). Moreover, this workshop will explicitly engage critical pedagogies associated with Paulo Freire and bell hooks--pedagogies that are aimed at addressing concerns of inclusion and justice--and integrating these into STS pedagogies. Additionally, this workshop will be organized with attention to including participants with a heavy teaching focus, who are often located in community and state colleges and universities, as well as museum educators and individuals involved in community outreach and education. With the goal of engaging and mentoring students, undergraduate students at James Madison University will participate in organizing and participating in the workshop.

The Need For This Gathering and a List of Topics

While the annual 4S meeting is an obvious candidate for such a workshop, this meeting is often held in locations and at times that are very challenging for STS scholar-teachers located in

teaching-oriented institutions that have less funding for research or graduate support. For example, the last three 4S meetings that were held in the United States were held at a time that is often the first or second week of classes in institutions on a semester system. For faculty focused on teaching who may not have any TA support and who may teach three or more undergraduate classes per semester, even if cost were not an issue, it is often untenable to miss a full load of classes just as the semester is starting. Yet, many STS scholars are located in such positions. Not only is their contribution to STS research still valuable, there is enormous interest in how to do STS pedagogy in their various disciplinary, institutional, or departmental contexts--whether they are teaching in a STEM program or in the liberal arts. Often, outside of an "STS department," these STS scholar-teachers may be somewhat isolated in relation to their focus on STS pedagogy. At the same time, their deep engagement with teaching and learning alongside the constraints of this position also constitute an opportunity for rethinking STS pedagogy as a site for scholarly inquiry connected not only to how we do pedagogy but also to how we do STS.

The Resources page of the 4S website contains a list of syllabi, originating from an NSF-funded workshop in 2003. 16 years later, with a new generation of STS scholars and teachers, we envision this workshop as a space to not only build on this previous work and generate additional catalogs of resources, but to forge a community of scholars interested in STS as Critical Pedagogy.

Topics of this workshop may include but not be limited to:

- STS as critical pedagogy
- Pedagogy as critical participation
- Integrating STS pedagogies in STEM courses
- Challenges and opportunities of co-teaching with STEM colleagues
- Teaching ethical reasoning
- What is "hands-on" STS in undergraduate pedagogy?
- Undergraduate laboratory studies
- Science fiction in STS pedagogy
- Making and doing
- Implementing STS minors and programs
- STS for pre-med students
- STS research with undergraduate students
- Feminist, Postcolonial STS pedagogies
- Film in STS pedagogy
- Wikipedia projects as STS pedagogy
- What is a fact? And other questions for STS pedagogies in a Trump era
- Pedagogies at the intersection of STS and disability studies
- The classroom as a site for STS research
- Teaching and learning as collaborative knowledge production

Recent Meetings on STS and Pedagogy

While there have been panels and sessions at STS meetings on topics related to STS and pedagogy, showing a clear interest in this area, there have been few dedicated spaces for rigorously cataloging, theorizing, and assessing STS pedagogy, or for investing in a community of practice focused on STS as Critical Pedagogy at the intersection of scholarship and pedagogy.

The list of open panels at the 2019 4S meeting includes several related panels, including one that the PI and Co-PI have proposed with Dr. Marisa Brandt on “STS as Critical Pedagogy: Experiments in Undergraduate Teaching and Learning.” Additional open panels of interest include: “STS Pedagogy: Methods for Teaching Sociotechnical Ethics”, “Sustainability & Transformation in Engineering and Engineering Education” and “Alternative Pedagogies at the Crux of Interdisciplinarity: Promises and Pitfalls of ‘Innovating’ Education.”

Other panels and session in recent history include:

- Panel at EASST 2018: “Teaching STS in an age of post-truth. Sharing challenges, approaches and experiences.” Lancaster University, United Kingdom. July 27, 2018.
- Mini panel/workshop at graduate conference MidweSTS 2018: “Strategies for teaching STS.” University of Wisconsin, Madison, United States. October 26-28, 2018.
- Session Track at the 18th Annual STS Conference Graz: “Teaching STS.” Graz, Austria. May 6-7, 2019. Panel sessions listed below:
 - S21: Engineering education and STS: courses and teaching/learning units on the social and ecological responsibility of engineers
 - S22: Engaging with the diversity of pedagogical experiences beyond the analysis of controversies
 - S23: Teaching STS: a call for workshop participation
 - S24: Meaningful science and technology education for kids
- UVA hosted a table about doing STS with engineering students at 4S in 2017 (in the interactive Making and Doing session)

Nevertheless, the only dedicated workshop on STS and pedagogy that we have found is the previously mentioned NSF-funded workshop on STS and pedagogy in 2003, which is no longer recent but suggests that this is an important topic that could benefit from renewed attention.

Organizing Committee

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Marisa Brandt, Teaching Professor in the History, Philosophy, & Sociology of STEM, Center for Gender in Global Context Core Faculty, Michigan State University - Lyman Briggs College

Karen Rader, Professor, Department of History, Virginia Commonwealth University

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D.E. Wittkower, Associate Professor, Department of Philosophy, Old Dominion University

Sean Ferguson, Assistant Professor, General Faculty, SEAS, E&S, Science Technology and Society, University of Virginia

Location and Dates

This workshop will be hosted at James Madison University in Harrisonburg, Virginia, in the summer of 2020. James Madison University recently built a new hotel and conference center, Hotel Madison, which provides special per-diem room and meal rates for university activities.

Participants will be recruited utilizing the networks of the advisory board (which includes a K-12 educator), as well as STS listservs such as the Science and Democracy Network, STSgrad, and Eurograd, among others.

Meeting Plan and Dissemination of Results

The STS As Critical Pedagogy two-day workshop will focus on community formation, and therefore will eschew more formal paper presentations in favor of round-table discussions, interactive sessions, and facilitated collaboration to define and elaborate on STS as "critical pedagogy." Rather than traditional proposals, we will invite prospective participants to submit a definition of STS as critical pedagogy along with several keywords that articulate their connection to this subfield. These definitions and keywords will be used to organize collaborative working groups to elaborate an area of this subfield and to form pop-up sharing and interactive sessions within the larger workshop. This workshop will forge lines of communication between STS scholars who are engaged in STS pedagogy, which will support further collaboration and intellectual inquiry into this subfield.

Activities will include:

- Publicize workshop and select participants
- Organize workshop logistics
- Keynote address
- Roundtable discussions
- Undergraduate poster session
- Interactive sessions
- Collaboratories
- Mentoring program for junior faculty, graduate and undergraduate students
- Formation of network communications, shared goals and objectives
- Closing

When participants complete registration at Hotel Madison, their meeting agenda and information will include an explicit Harassment-Free Environment policy, in accordance with NSF policy, that outlines the following:

- A no-tolerance policy that is in accord with university, state, and federal requirements
- Information on how to report any sexual harassment or sexual assault violations
- An affirmative statement of inclusiveness

Results from Prior NSF Support

N/A

Conclusion

This workshop will bridge STS scholarship and pedagogy and undergird the development of STS as critical pedagogy--as a subfield of STS and as an active community of teacher-scholars engaged in developing this subfield. We envision this gathering as a way of bringing together both new and established individuals (many of whom are underrepresented and inhibited from attending large gatherings such as 4S due to teaching obligations during meeting dates as well as funding limitations) who can share best practices, successes, and challenges around cultivating and interrogating learning environments in which STS is deployed as a disruptive, experimental intervention. In addition to community formation, training activities, and mentoring of graduate and undergraduate students, tangible outcomes of the workshop will include updating and expanding the syllabus resource base developed in 2003, creating an additional syllabus resource for K-12 educators, creating an online accessible repository of classroom activities, as well as developing case studies and other scholarly interrogation of STS as critical pedagogy for publication in special issues of journals, and an ultimate goal of developing an edited handbook of STS as critical pedagogy that can serve as an accessible resource for a range of educators, including those from K-12, college and university, and museum communities, among others. Moreover, it will highlight the possibilities for reconceptualizing sites of STS teaching and learning as opportunities for mutual, collaborative knowledge production and scholarly inquiry into STS theories and methods.