

Research Article

Coding Equity: Social Justice and Computer Programming Literacy Education

—ASHLEY REA 

Abstract—Background: *Computer programming faces persistent problems of inequity. In response, bootcamps and workshops have rapidly responded by offering an introduction to coding literacy intended to increase access and representation in the tech industry. Literature review:* Prior research on software development focuses primarily on workplace contexts. This study considers bootcamps and workshops outside the workplace for minoritized and marginalized software developers to better understand the institutional contexts in which programming is taught and made. In so doing, it contributes to ongoing conversations on strategies for social justice in technical communication. **Research questions:** 1. How do bootcamps and workshops function as sites of coding education? 2. What strategies do activist programmers use in bootcamps and workshops to work towards social justice goals? **Methodology:** For this research, I interviewed organizers, instructors, and participants at three coding workshops and bootcamps for marginalized communities. I also conducted participant observation of the workshops, collected educational materials, and analyzed the interview transcripts using a grounded theory approach. **Results and discussion:** This analysis revealed how coding workshops and bootcamps operate as literacy sponsors, contributing to a transformative access for participants. More specifically, my research describes how activist programmers craft open, inclusive, and culturally aware pedagogies by attending to access, representation, community, and active learning, ultimately facilitating an affective coding literacy.

Index Terms—Coding bootcamps, computer programming, intersectional feminism.

Over the past decade, coding bootcamps and workshops have exploded in popularity, especially for individuals without traditional computer science backgrounds. More and more tech workers are graduates of these bootcamps, contributing to public narratives that link bootcamps to economic uplift. For example, in his 2016 State of the Union Address, US President Barack Obama described coding bootcamps as a “ticket to the middle class,” lauding the economic impacts of the educational model [1]. However, the actual outcomes of these bootcamps are much more complex. Nor are coding bootcamps and workshops created equally in regard to their focus on increasing equity in tech.

In response to pervasive problems of representation in computer programming, antiracist and feminist software developers have created coding workshops and bootcamps to increase access to coding

education and work toward equity in computer programming. However, the field of technical and professional communication (TPC) has only recently begun to examine the relationships between sites of coding education, identity, and equity [2], [3]. Furthermore, much research on software development focuses on workplace contexts [4], [5] or specific software for technical communication-management systems [6]. Because of the growth of coding bootcamps and workshops and their influence on software development, it is essential to learn more about the enterprise of contemporary programming education—to focus not just on the technical communication embedded within code, but also the institutional contexts in which code is theorized, taught, and written.

New forms of coding education offer a generative site to consider how activist programmers are working to create more inclusive professional communities and more just technologies. In this article, I present three coding workshops for minoritized and marginalized communities as case studies. I share interviews with organizers, instructors, and participants from each organization, contextualized with participant observation, and describe their strategies for creating inclusive sites of coding education. This study contributes to ongoing conversations about

Manuscript received March 15, 2021; revised October 15, 2021; accepted October 16, 2021. Date of publication February 28, 2022; date of current version March 17, 2022. This research was supported by a grant from the College of Liberal Arts and a predoctoral fellowship from the Center for Humanities and Information at Penn State University. The author is with the Humanities and Communication Department, Embry–Riddle Aeronautical University, Prescott, AZ 86301 USA (email: ashley.rea@erau.edu).

IEEE 10.1109/TPC.2022.3143965

Practitioner Takeaway

- Organizers and instructors of coding workshops and bootcamps created strategies to increase access, representation, and community in coding education contexts.
 - Participants of coding bootcamps for minoritized and marginalized individuals gained an affective coding literacy that supported their professional development.
 - Instructors in professional communication and technology contexts can adopt open, inclusive, and culturally aware practices to better meet the needs of learners.
-

social justice in TPC [7] and may help instructors better attend to diversity, equity, and inclusion in their classrooms.

LITERATURE REVIEW

To situate my study of coding literacy education for minoritized and marginalized communities, I drew on three areas of research. First, I reviewed the literature on the social justice turn in TPC to position my study within a scholarship that seeks to understand how TPC both perpetuates and provides opportunities to challenge injustice. Second, I reviewed the literature on coding bootcamps and workshops to historicize the growing industry of coding education. Finally, I reviewed literature that considers the relationship between coding and literacy to illuminate the ways in which coding workshops and bootcamps function within larger economies of literacy. Altogether, these three areas of literature allow me to contextualize specific strategies used by activist programmers working toward social justice ends.

Social Justice Turn in TPC Despite its claims to neutrality, TPC as a practice and discipline is complicit in structural oppression [8], [9]. Social justice research takes up the problem of injustice and discrimination in TPC research and workplaces, illuminating both problems of inequity and possibilities for change [10]. Issues of power, privilege, and positionality circulate through professional communication—often perpetuating a problem that Jones labels as “political, problematic, and patriarchal” [11, p. 515]. Jones argues that technical communication is fundamentally about advocacy [12], urging researchers to adopt a critical stance on issues of social justice and diversity. Social justice research considers how TPC can be used to “amplify the agency of oppressed people—those who are materially, socially, politically, and/or economically under resourced” [13, p. 242].

Within the studies of technology and equity, researchers have theorized code as intrinsically rhetorical, shaped by the implicit assumptions of its creators [14], [15]; analyzed the effects of biased and discriminatory technologies [16]; and examined how individuals and communities mobilize technologies toward social justice ends [17], [18]. Researchers have also considered how gender influences professional identity and communicative practice [19]–[21] and analyzed how workplace bias causes individuals with marginalized identities to leave science, technology, engineering, and mathematics (STEM) fields [22]. Finally, Jones urges researchers and teachers in technical communication and composition to come together toward shared goals for more socially just pedagogies and practices, a vital practice “if both fields intend to pursue a more just and ethical approach to teaching, learning, and engaging with texts and technologies” [11, p. 517]. Following her call, I bring together scholarship on coding bootcamps with research on literacy acquisition to contextualize the case studies at the center of this article.

Historicizing Coding Bootcamps and Workshops

Coding bootcamps first emerged as venues for programming literacy acquisition in 2011. Though several organizations are credited with starting the coding bootcamp model (including Code Academy and Hungry Academy, among others), by the end of 2011, coding bootcamps were recognized as a way to acquire programming literacy outside traditional avenues of university and self-teaching [23]–[25].

The coding bootcamp model offers a streamlined education in computer programming oriented toward the basic skillset needed to work in the tech industry. Bootcamps differ from four-year computer science degrees in several significant ways. According to the 2020 Course Report annual guide, an industry guide to coding bootcamps, the average coding bootcamp costs \$13,500 and takes 14 weeks (though durations vary from six weeks to 28 weeks). In 2019, coding bootcamps “graduated

23,000 students and grossed \$309 million [USD] in tuition revenue” [26]. Bootcamps offer different models for financing tuition and job placement after graduation.

Coding bootcamps traditionally focus more on programming syntax and problem-solving, rather than higher-level theory and mathematics taught in computer science programs [27]. Most coding bootcamps are taught in person, and many require full-time enrollment. Coding workshops offer similarly structured avenues for programming literacy education at much shorter durations. Most coding workshops last several hours to several days, with some operating several hours a week for a set time span. Many of the workshops surveyed in this research offer introductory lessons in front-end web development. Though varying in duration and cost, bootcamps and workshops offer a similar level of structured education.

Bootcamp demographics reflect larger demographics within existing tech landscapes, albeit with slightly more gender diversity. The 2020 Course Report annual survey found that the typical bootcamp participant is 31 years old, has six years of work experience and a bachelor’s degree, and has no previous experience as a programmer. In total, 71% of bootcamp participants identify as White; 12%, Latino/a; 9%, African American; 12%, Asian American; and 2%, Native American or Pacific Islander. In total, 62% of bootcamp participants identify as men, with 35% identifying as women, and 2% as nonbinary. Over half of bootcamp participants (63%) already hold a bachelor’s, master’s, or doctoral degree prior to enrolling in the program.

This breakdown emphasizes the ways in which bootcamps are most often used by individuals with existing social capital (education, middle-class income, identity-related privileges) in their transitions from other occupations. However, coding bootcamps often tap into narratives of economic uplift and personal fulfillment.

Placement results from coding bootcamps present a more complex story than the narratives that connect learning to code with high-paying careers. Since the industry’s inception, coding bootcamps have tracked graduation statistics in various ways. Course Report’s 2020 analysis found that a majority of bootcamp participants (83%) are employed full time using some tech skills following their completion of the program, and the average participant’s salary increases by \$22,000 USD.

Low-income students, although a much smaller percentage of bootcamp participants, see salary increases of 180%. However, these statistics do not necessarily account for the more problematic practices that coding bootcamps use to inflate their numbers, including hiring their own graduates for transitional teaching positions. Furthermore, coding bootcamps as an industry have faced serious critique for the lack of accessibility of their programs.

Although many have praised coding bootcamps as a means to career advancement, Pathak [28] challenges the presupposition that coding bootcamps are accessible paths to economic mobility. The vast majority of bootcamps are full-time, requiring participants to stop working to attend. These hidden costs often make coding bootcamps unattainable for many low-income individuals. In 2015, the Obama administration launched the Educators Evaluating the Quality of Instructional Products (EQUIP) initiative to offer federal student loans to participants in coding bootcamps that partnered with certain universities.

As the coding bootcamp industry has grown, a market for private lenders has grown as well, with 49% of participants in 2019 using the private lender Skills Fund. Other bootcamps have developed income sharing agreements and deferred tuition arrangements, taking a certain percentage of student’s income after graduation, or deferring tuition until the student is employed full time in tech. Even with new tuition models and financing options, participants from under-represented backgrounds can face challenges in attending bootcamps.

In response to the problem of access, activist programmers have created bootcamps and workshops explicitly designed for women, people of color, and LGBTQIA+ individuals. In this article, I consider three such coding workshop case studies.

Coding Literacy and Bootcamps as Literacy Sponsors Considering coding as literacy opens up a space to consider coding bootcamps as a literacy sponsor. Common examples of literacy sponsors include churches, schools, and workplaces. With the growing need for computer programmers outpacing the number of students graduating with computer science degrees, coding bootcamps offer a new form of programming literacy education. Brandt first theorized that literacy sponsors are

any agents, local or distant, concrete or abstract, who enable, support, teach, model, as well as

recruit, regulate, suppress, or withhold literacy—and gain advantage by it in some way. [29, p. 167]

In Brandt's model, literacy sponsors function as "delivery systems for the economies of literacy" [29, p. 167]. Early bootcamps were often directly sponsored by tech companies, making concrete the relationship between literacy and economic opportunity.

As Brandt argues, literacy is imbricated within systems of power and privilege, where access and varying patterns of literacy sponsorship reveal inequities in "subsidy and reward for literacy" [29, p. 172]. Brandt described literacy sponsors as follows.

These are the systems that deliver large-scale economic, historical, and political conditions to the scenes of small-scale literacy use and development. This analysis of sponsorship forces us to consider not merely how one social group's literacy practices may differ from another's, but how everybody's literacy practices are operating in differential economies, which supply different access routes, different degrees of sponsoring power, and different scales of monetary worth to the practices in use. [29, p. 172]

Understanding how coding bootcamps function as literacy sponsors is critical to untangling the interwoven threads of economic motivations, industry standards, and the coding literacy gained by participants. As literacy sponsors, coding bootcamps participate in these uneven economies of literacy, offering varying degrees of access and financial benefit. Computer programming has been hailed as one of the few paths to a high-paying career without a four-year degree, even though the majority of bootcamp participants already have four-year degrees. Yet as literacy sponsors, not all bootcamps offer paths to economic mobility. As with print literacy, coding literacy is imbricated within networks of capital and power.

As software increasingly underwrites the landscape of daily interaction, coding literacy can offer a means to "transformative access," what Banks theorizes as an African American tradition that functions as "a means to transform both society and its technologies" [30, p. 2]. Banks goes further to argue that technology access should be of central importance to the fields of writing studies, explaining that

technologies are the spaces and processes that determine whether any group of people is able to

tell its own stories on its own terms, whether people are able to agitate and advocate for policies that advance its interests, and whether that group of people has any hope of enjoying equal social, political, and economic relations. [30, p. 10]

Drawing on Banks' research, Byrd characterized coding bootcamps as literacy sponsors, and troubles the literacy myth accompanying a coding bootcamp for low-income, racially-minoritized individuals [31]. Byrd explains,

The results of this intense training present a new coding literacy myth: an imagined future in which coding literacy education addresses digital racial inequality, helps low-income people of color have a lucrative career in software development, and evolves the tech industry into a more culturally inclusive space. [31, p. 32]

Byrd's research analyzes how

adults in computer code bootcamps learn a new prestigious literacy practice in the midst of a complicated system of inherited disadvantages that shape how they learn computer programming. [31, p. 49]

His study reveals the ways in which learners rely on material and nonmaterial networks of support as they participate in coding bootcamps.

I extend Banks' transformative access to focus specifically on computer coding as a literacy and the practices of participants and organizers in coding workshops. Heeding Byrd's critique to avoid simply replicating a new coding literacy myth, this research considers the three case studies' material and institutional contexts, and the ways in which workshop organizers and instructors respond to inequity in their field. Traditionally, literacy sponsors are understood as institutions that "deliver the ideological freight which must be borne for access to [the literacy] they offer" [29, p. 168]. But as participants in this study show, in coding bootcamps and workshops designed for marginalized communities, these literacy sponsors can offer a transformative access that facilitates the reappropriation of coding literacy toward equitable ends. Furthermore, analyzing these bootcamps and workshops creates an opportunity to understand how they counter cultural narratives about who "can" code. Participants in these workshops gain an affective literacy tied to a learner disposition of confidence.

RESEARCH QUESTIONS

In the literature review, I examined how computer programming bootcamps and workshops function as sponsors of coding literacy acquisition.

Considering how coding is taught and practiced outside traditional educational contexts enriches professional communication research on software development. Centering coding bootcamps and workshops for marginalized and minoritized software developers contributes to ongoing conversations on social justice in TPC. Therefore, this study asks the following questions.

RQ1. How do bootcamps and workshops function as sites of coding education?

RQ2. What strategies do activist programmers use in bootcamps and workshops to work toward social justice goals?

RESEARCH METHODS

Study Design This research comes out of an ongoing study of sites of coding education. Contemporary coding education exists in four main forms: online educational platforms (e.g., Codecademy), hybrid online and in-person meetups (e.g., Women Who Code), bootcamps and workshops (e.g., the Grace Hopper Program), and university courses and microcredentialing programs.

My study is grounded in an intersectional feminist theoretical framework. Intersectional feminist research considers how interlocking systems of oppression influence the lived experiences of multiply-marginalized individuals in differing ways depending on their positionalities [32]. An intersectional approach is critical for social justice work in professional communication. Walton et al. stress the necessity of centering marginalized perspectives, which

makes space for people to move toward the center, allowing them to shape, re-imagine, and re-envision the institutions and organizations forming the context for much of TPC. [10, p. 9]

Such centering is especially vital for feminist technology interventions, which too often focus on privileged White women, erasing the experiences of women and girls of color [33]. To that end, this research focuses on sites of coding education explicitly designed by and for minoritized and marginalized communities. Furthermore, as a White woman working with organizations often led by women of color, I draw on intersectional

feminism to adopt a reflexive stance and practice reciprocity with the communities that I participated in [34]. As part of this practice, I became an active participant in the organizations I discuss here, learning from other participants and contributing my own experience and resources when appropriate.

Recruitment I recruited participants by reaching out to coding organizations designed to increase access, representation, and equity in the tech industry. Many activist coding organizations have a national or international reach, but I chose to focus on organization chapters in the northeastern US and Canada to facilitate in-person engagement. For this article, I narrow my analysis to coding bootcamps and workshops specifically. Three organizations that offered coding bootcamps and workshops agreed to participate in my study. After obtaining permission from the organization leadership, I registered for each organization's coding workshop or bootcamp. I recruited interviewees by following up with other workshop and bootcamp participants and posting in each organization's Slack channel. This study was approved by the Pennsylvania State University Institutional Review Board (IRB) (protocol #00013963).

Participants My ongoing study features 16 participants at the time of writing. In this article, I focus specifically on the six participants involved with three coding workshops and bootcamps. Five of the participants were women, and one was a man. Of the women I spoke with, two identified as Asian, one as Black, one as Latina, and one as White, whereas the male participant identified as Black. Two participants worked as software engineers, one as an academic technologist, one as a librarian, and one as a doctoral candidate in information sciences and technology; one was transitioning from digital humanities nonprofit to software development.

All were deeply invested in diversity, equity, and inclusion work in their personal, professional, or academic contexts. Most participants had extensive experience in teaching and so brought a significant depth of knowledge to our conversations on coding literacy education. Two participants had formal university training in programming, whereas the others learned through a variety of coding meetups, workshops, and bootcamps. This small sample is intentionally not representative of the larger US computing industry, which in 2020 was 75% male and 65% White [35]. Instead, these participants

TABLE I
CODING WORKSHOP CASE STUDIES AND INTERVIEW PARTICIPANTS

Case Study	Audience	Focus	Duration	Interview Participants
W1	Women of color	Front end web development, user experience, professional development	One-day workshops and multi-week bootcamp held in person and online	Olivia (organizer); Kassandra (participant)
W2	Underrepresented developers (in terms of race, ability, gender, orientation, etc.)	Go lang (object-oriented procedural language developed by Google)	One-day workshop held in person	Sophie (organizer); Danny (instructor)
W3	Women and gender-diverse students, faculty, and staff	Front end web development (HTML, CSS, JavaScript)	Nine-week workshop (series of 2-hour long classes)	Ana (organizer); Julia (instructor)

often spoke to the ways that their positionalities informed their feminist and antiracist practices as organizers, instructors, and participants in coding workshops. See Table I for a specific breakdown of each organization's audience, focus, duration, and the interview participants' roles.

Case Studies In this section, I describe the mission and structure of each organization's workshops to frame my participant observations and interview research. For the first case study, W1, I selected an organization created to help women of color thrive and move up in the tech industry. W1 offers monthly programming literacy workshops as well as professional development opportunities, and works with local tech companies to foster diversity, equity, and inclusion. The organizer Olivia took on leadership of the group shortly after its inception in 2014. Though it began as a meetup for women to attend tech events together, its purpose quickly shifted under Olivia's leadership. As she explained, "... I didn't just want us to be going to events. I wanted us to get in on the skills." To that end, this organization offers a sequence of in-person coding education workshops, from a front end web development class to an introduction to user experience. The onset of the COVID-19 pandemic disrupted the organization's in-person education, and it transitioned to an online format. For my research, I attended a virtual coding workshop on tech career development skills and interviewed Olivia and Kassandra, the workshop participant.

For the second case study, W2, I chose an organization dedicated to fostering diversity in Go, an open-source procedural, object-oriented programming language developed by programmers

at Google and in the open-source community. For this research, I attended a one-day workshop introduction to Go and interviewed the event organizer, Sophie, and the workshop instructor, Danny. The workshop was limited to participants who identified as under-represented in technology in at least one way. Most participants had previous experience programming in other languages like Python or JavaScript and already worked in technical roles. This workshop taught the most complex content out of my three case studies, as suited their more specialized audience.

Finally, the third case study, W3, was a nine-week extracurricular coding workshop held at a large public university. The workshop taught introductory principles of coding for front-end web design, and was open for undergraduate and graduate students, staff, and faculty who identified as women and gender-diverse (for example, trans and nonbinary). It was created by Ana, a librarian in the College of Information Sciences and Technology (IST). The weekly 2-hour workshop (offered as one section for students and one for faculty and staff) was taught by Julia, a Ph.D. candidate in IST at the time. The workshop offered a scaffolded approach to learning HTML, CSS, and JavaScript so that students left having coded a functioning website.

Though the three case studies comprise a convenience sample, I argue that taken together, they offer meaningful insights into how coding workshops and bootcamps might increase access, equity, and representation in technology. In the following sections, I address RQ1 by introducing the exigencies informing organizers' decisions to create their coding workshops and bootcamps. These experiences shed light on the professional

contexts facing marginalized and minoritized tech workers and shape their organizations' aims and structure. Next, I describe how workshop instructors cultivated "open, inclusive, and culturally aware" pedagogies. Finally, I address RQ2 by analyzing five strategies used by workshop organizers and instructors.

Data Collection Procedures For this research, I collected three kinds of data: audio-recorded and transcribed interviews with coding workshop and bootcamp organizers, instructors, and participants; workshop materials (digital handouts, slides, and educational websites); and fieldnotes. At the start of my research in early 2020, I conducted participant observations and interviews in person, but following the onset of the COVID-19 pandemic, I switched to participant observations of online coding workshops and conducted interviews over video call.

Following my IRB protocol, I refer to organizations and participants using pseudonyms to protect participant privacy. For interviews, I used a semistructured approach, working with a standard set of questions and asking unscripted follow-up questions when needed. My question categories included coding learning or teaching practices, experience in coding bootcamps and workshops, professional experiences, and response to industry challenges.

Data Analysis Procedures I transcribed the interviews and analyzed them using grounded theory [36], [37]. I started with *in vivo* coding to center participant's descriptions of their experience. The *vivo* codes were taken directly from participant's own words and included "inclusive," "empowerment," and "community." After grouping the *in vivo* codes into related clusters, I reflected on my field notes in analytic memos. Next, I used axial coding, a method to consider the relationship between the categories of codes. Examples of axial codes included: "student outcomes," "literacy definitions," "exigencies," and "barriers to participation." Finally, I crafted thematic codes to analyze participants' strategies for their social justice work in their coding workshops and bootcamps. See Table II for examples of the thematic codes and descriptions. This study prioritizes sharing research participants' stories in their own words whenever possible and uses a practice of member-checking. I shared the interview transcripts and my analysis with participants, inviting them to review how they were represented in this article.

RESULTS AND DISCUSSION

In this section, I first discuss the exigencies informing organizers' decisions to create their coding workshops and bootcamps. These experiences shed light on the professional contexts facing marginalized and minoritized tech workers and shape their organizations' aims and structure. Next, I describe how workshop instructors cultivated "open, inclusive, and culturally-sensitive" pedagogies to examine how the workshops operated as sites of coding education. Finally, I offer an analysis of the five specific strategies by coding workshop organizers, instructors, and participants as they worked to make more equitable coding education and industry.

Exigencies for Coding Workshop Organizers

Organizers like Olivia, Ana, and Sophie turned to their past experiences when describing their motivations for founding and organizing coding workshops for marginalized communities. Institutional barriers, lack of representation, and challenging learning environments characterized their experience with formal computer science education. In response, Olivia, Ana, and Sophie each sought to change the conditions for participation in coding.

Olivia explained the mission of her organization for women of color by saying, "I'm literally trying to change the face of technology. Women of color are in this space, and we're not going anywhere." She became involved with her local tech community when she decided to change careers and began attending meetups and workshops to "bone up on some extra skills." In response to the prevailing whiteness of local feminist technology groups, Olivia founded an organization to create a space for women of color to lead, teach, and learn. Her workshop offers coding education that emphasizes both the "hard" technical skills as well as "soft" skills for career development. Olivia explained her workshop's purpose as follows:

I'm teaching women how to code. But it's bigger than that. What I'm really teaching them how to do is how to unlearn what they've been taught. A lot of women of color, or women in general, have not been taught that science, math, coding, you name it, is for them. You're unlearning a thing, and you're learning a new skill.

Olivia's organization functions as a site for coding education that foregrounds the innovative appropriation of coding literacy, creating

TABLE II
THEMATIC CODES AND DESCRIPTIONS

Code	Research Question	Description	Sample from Interviews Corresponding to Label
Exigencies for workshop organizers	RQ1	Participants described the origins of their coding workshops and social justice practices.	"I'm literally trying to change the face of technology. Women of color are in this space, and we're not going anywhere." (Olivia)
Open, inclusive, and culturally aware pedagogy	RQ1	Energy conversion	"Be[ing] creative, innovative in the classroom and being ethical and culturally aware [are] many things that I think a lot of traditional CS [pedagogy] lacks." (Julia)
Increasing access	RQ2	Participants described their pedagogical aims.	"I've been lucky to have seen how people's lives change once you teach them a skill or at least show them that they can shed fear of learning something technical.... I saw firsthand what [happens] once you grab somebody by the hand and walk them through the threshold. My goal ultimately is to open these doors for as many people as I can in the tech industry." (Danny)
Centering representation	RQ2	Participants described how their workshops centered representation at the level of instructors, organizers, and teaching materials to encourage participants to see themselves as technical.	"If you don't see yourself in that role, how can you get there? That identity piece rolls back into representation. You have to see it to believe it, to believe that it even is a possibility for you." (Olivia)
Facilitating active learning	RQ2	Participants described how their workshops facilitated active learning by asking participants to work together to solve complex problems.	"I'm using constructivist approaches where you're taking an active process of constructing knowledge and learning.... I try to think of activities [that promote] hands-on learning by doing." (Julia)
Cultivating community	RQ2	Participants described how they designed their workshops to cultivate community so participants have networks of support as they enter industry context.	"When I teach somebody, I'm not just teaching that one person. I'm thinking, OK, what is the impact that this person is hopefully going to have on their family and the people around them?" (Danny)
Fostering affective literacy	RQ2	Participants described the literacy outcomes of their workshops.	"The learning gains are important, but it's not going to be the same for everybody... We want people to feel empowered. I want everyone to get out of [the workshop] whatever they can knowledge-wise, but also, feeling empowered and confident, a sense of being able to do more things than they anticipated." (Julia)

"infrastructures of opportunity" in Brandt's terms, and working toward transformational access [29], [30]. Olivia's story illustrates how coding workshops and bootcamps can function as sites of literacy acquisition outside traditional classroom settings.

For Ana, the lack of female representation in programming led her down an entirely different career path. She was inspired to start her coding

organization after meeting Girls Who Code founder Reshma Saujani at a national conference and reflecting on the composition of the classes that she had worked with in her college. Ana explained, "I wasn't really confronted with [demographics in computer science] until I went into the classroom to do a library instruction and saw with my own eyes," leading her to ask, "Where are all the women?" She wondered what would have been different if she had had access to the examples of

women in programming, motivating her to create her coding workshop.

Sophie also referenced institutional barriers facing members of under-represented communities in tech after they land their first job in the industry. As a “North American-born, English-speaking, cisgender East Asian woman,” Sophie acknowledged her own positionality and relative privilege and described the ways in which her identity influenced her own career as a software engineer. One key career challenge that Sophie highlighted was being perceived as occupying less technical roles (like recruiter or intern) by senior software engineers. As Sophie explained,

Existing as a woman in tech means that you always have to be hyperaware of how you’re being branded at all times. People tend to round you down to the least technical thing you’ve done recently. For example, if you work on a team of all engineers, you are an engineer by job title regardless of [your] level. If you organize a team dinner and everyone has fun at the team dinner, then the feedback you’re going to get at the end of that quarter is, “Oh, everyone thinks she’s so good at organizing team dinners.” But guess what your male colleagues are getting? Your male colleagues are getting: “Oh, John is such great technical contributor.” And guess who gets promoted?

Marginalized and minoritized programmers face identity-based gatekeeping and are often left behind in established systems for promotion. Sophie’s experience with such discrimination spurred her to take on diversity, equity, and inclusion leadership roles in tech. She described how she worked to increase access and center representation, explaining,

I like creating a pipeline of people who are interested in the Go language so that eventually [they] get to the point of being able to present as public thought leaders or role models [to] kick off a positive feedback loop.

Each organization discussed in this study has worked to create a similar “feedback” loop for participants and the wider industry through their pedagogical practices.

Open, Inclusive, and Culturally Aware Pedagogy

When Julia described her teaching, she envisioned “open, inclusive, and culturally aware pedagogy.” Each coding workshop attempted to make space for this inclusive pedagogy through approaches that

increased access, centered representation, cultivated community, and facilitated active learning and an affective coding literacy. In this section, I describe the pedagogical orientations of two coding workshop instructors, Julia and Danny.

Julia positioned informal contexts like workshops and bootcamps in stark contrast to formal sites of programming education like computer science departments. Despite her coding experiences at her STEM-specialized public high school and her IT-professional parents, she characterized her experience with formal computer science courses as inaccessible and alienating. Because of her negative experiences as a student, Julia stressed the importance of accessible and inclusive pedagogy, defining her own pedagogical goals as a reflection of current scholarship in computer science education and her desire to create a “nonthreatening” learning environment “where people can feel empowered.”

Similarly, Danny used his many years of professional experience to create welcoming and inclusive learning environments. He described a standard practice in coding workshops where participants receive “a firehose of information” that “gets overwhelming.” Often, instructors with more experience “forget what it’s like to be a beginner” and try to “impress” participants with how much they know. The results of that overwhelming information can be detrimental for participants from nontraditional backgrounds. Danny explained that it creates opportunities for confirmation bias, where participants feel “too stupid to learn this stuff.”

Instead, Danny centered his teaching on participants’ needs, going “very, very slowly to make sure [he] doesn’t lose anybody in the process.” By teaching using a structured sequence of content and activities all hosted online, Danny structured his workshop to help beginners while allowing more advanced participants to work ahead. Drawing on their professional and academic experience, both Julia and Danny strived to create welcoming learning environments for workshop participants, especially those who felt that coding was not “for” them.

Strategies My analysis of the interviews and coding workshops highlighted five key strategies for workshop organizers and instructors seeking to establish inclusive and culturally-sensitive pedagogies.

Strategy 1: Increasing Access: Newcomers to coding face systemic discrimination on the basis of race, gender, sexuality, and ability. Overt and institutionalized discrimination not only shapes sites of coding programming education but also runs rampant through tech workplaces, creating unwelcoming or hostile environments. In response to this widespread problem, the organizers and educators who were interviewed for these case studies each sought to lower barriers to entry for under-represented individuals in tech.

To do so, Olivia, Sophie, Danny, Ana, and Julia all highlighted the importance of creating accessible learning environments. Each coding workshop worked to increase access in several ways. All offered free or low-cost workshops designed to overcome common problems of accessibility (cost, duration, materials, location, and perceived knowledge prerequisites). All were held outside of standard work hours, hosted in spaces intended to be central and easy to reach via multiple forms of transportation, and marketed to emphasize that prior coding knowledge was not necessary for participation.

Olivia described how this focus on accessibility set her organization apart from many other coding education programs, explaining, “It’s always been about having a low barrier to entry.” The workshops are only \$25 a session, and participants are provided lunch. Olivia stressed that the material context matters for her coding workshop—as a literacy sponsor, her organization is deliberately working to change the conditions for participation in programming literacy. The workshops have been held at various tech company offices, as well as virtually, following the onset of the COVID-19 pandemic that rendered in-person gatherings unsafe.

Sophie and Danny’s workshop was also located in the office of a tech company, connecting industry and education. The intermingling of participants and mentors facilitated the sequence of structured activities used in the workshop. Using the tech company’s office as an event venue offered participants the chance to visualize what their own tech workplace might look like, in addition to allowing the company to benefit from the activism of organizers. To make the workshop more accessible for participants completely new to programming, the organization offered an “installation party” several days before the workshop to walk participants through downloading the developer environment so that

they might start off the program with the necessary tools.

Like Olivia’s workshop, Sophie and Danny’s workshop foregrounded the necessity of access. For Danny, accessible coding education works to counter “elitist” narratives and “artificial barriers surrounding tech in general.” Danny explained his experience as follows:

I’ve been lucky to have seen how people’s lives change once you teach them a skill or show them that they can shed fear of learning something technical I saw firsthand what [happens] once you grab somebody by the hand and walk them through the threshold. Say [to them] “There’s all these things you can do. There’re all these things you can be. There’s all these technologies and communities and job prospects, and this is available to you. Don’t be scared of it.” You just have to have somebody to show you what’s there My goal ultimately is to open these doors for as many people as I can in the tech industry.

The Go workshop accounted for the material conditions of participant’s lives, from finances to location and time, but also considered the importance of participant’s existing beliefs about the possibilities and challenges of learning to code. Sophie and Danny understood increasing access as a holistic process of “opening doors.”

Ana and Julia’s workshop was the only case study that took place on a university campus rather than in a large city, but it was also designed with access in mind. Ana described the importance of hosting her program through the university library, explaining the perception that “libraries are for everyone.” She cited workshop surveys where participants articulated that they would not have enrolled in a similar course run by the College of IST because of the assumed knowledge prerequisites for participation.

Ana also detailed her own efforts to make the technology required for the workshop easily available for participants. She described a situation with a university colleague who wanted to attend but chose not to apply because they lacked an adequate laptop. Ana shared that “they ha[d] the impression that they couldn’t do it, because their machine wasn’t good enough,” prompting her to ask, “How can I make sure that people know even if you don’t have a laptop of your own, we can help you?” The organizers’ attentiveness to the varied needs of participants and commitment to

accessibility served to lower barriers for entry to participation.

Strategy 2: Centering Representation: Organizers and instructors centered representation in their coding workshops, from the participant pool, instructors and teaching mentors, and even visual content in teaching materials. Each organization used different marketing and application practices to recruit participants from marginalized communities in tech. Cultivating specific participant populations and establishing expectations for participant attitudes is crucial to creating welcoming and accessible learning environments. Reflecting on her own experience as a “first-generation, Hispanic woman in STEM,” Julia explained the relationship between community, representation, and participation in the tech industry, arguing that

It just makes it really hard for people who have issues at home, or the lack of resources, [or] no accessibility to strive, especially because they don't have role models to look up to. People that look like me or someone who's Black as a CS person teaching or doing research.

She cited the lower number of people of color and women in computer science, claiming, “there is a disconnect in the culture,” particularly regarding traditional computer science education.

Olivia also emphasized centering representation as a critical practice to help women of color to take on technical identities. Olivia explained that she foregrounds representation in leadership. “I am intentional about having women of color be the leaders, so people can see themselves being in front of the class as well.” This representation continues to her workshop's pedagogical materials although many coding workshops ask participants to use filler content like cat photos for lessons on formatting images on webpages. Olivia decided on a more intentional practice for her workshops.

... what I want people to see, what I want these women of color to see, is themselves. I want you to highlight yourself or someone that looks like you. We're going to get pictures of women of color there and say, hey, use these pictures as a filler for your content.

She argued that representation is vital for professional development.

Strategy 3: Facilitating Active Learning: Each workshop facilitated active learning, where

instructors sought participant contributions in their short lectures and created opportunities for collaborative practice and individual problem solving. Drawing from her experience with user experience, Julia described the tension she felt between structured aspects of teaching like formal lectures and more student-centered, informal activities. One way that Julia encouraged active learning was through her emphasis on coding collaboratively. For example, when a student asked how to insert a hyperlink into her website, Julia replied, “Good question. Let's do it together.”

In a typical session, Julia would begin with a brief lecture explaining fundamental concepts, asking the class to code along with her as she explained the syntax. Next, she would incorporate small group activities, such as collaboratively coding a basic page using her code as a base to craft small group introductions. Julia explained her motivations by saying,

I try to follow two things: being inclusive, checking for understanding, answering questions, trying to think of like what are ways that I can try to make everyone feel comfortable in the classroom

and “hands-on learning by doing.”

In the coding workshop on Go, Danny started by describing the language's origins and the development of the Go community. As an early adopter, Danny described how he became involved in the workshop to shape the nascent Go community. Drawing on his experience in the more diverse and welcoming Ruby programming language community, Danny outlined his mission to create a community that welcomed “all members of society to participate and to enjoy the benefits of the language.” As a participant, I quailed when Danny called on me to answer a question about naming conventions. I guessed, using a rule discussed previously, and was wildly wrong. Danny patiently listened and gently corrected, “I can see where you're going, but the point I'm trying to get to” Later, when another participant expressed their confusion, Danny encouraged them, saying, “Struggling is how you learn. The things you remember the most in your life are the things you struggled to learn.”

Turning to the group, Danny used the moment to reinforce that “nobody's born knowing how to do this.” As the workshop continued, Danny alternated between short lectures and breakout

sessions where participants worked on coding challenges. His workshop was not intended to provide a complete overview of Go but rather a foundation to equip participants to self-teach after the workshop. As Danny taught, he welcomed participant feedback and questions, explicitly characterizing the workshop as the opposite of “sage on the stage” pedagogy. Mironova et al. examined how active learning practices are especially important for teaching non-IT students [39]. But often, research in coding pedagogy stops with pair programming practices [40]. The coding workshops discussed here moved beyond pair programming, coding along with an instructor, to more complex problem solving with mentors and small group activities.

Strategy 4: Cultivating Community: Coding workshops explicitly emphasized the necessity of cultivating community for professional, pedagogical, and personal contexts. From the first meeting, Julia and Ana stressed the value of the group of participants, describing us as coming “from all different backgrounds and levels” with technology, and urging participants to “take advantage of [the] opportunity to network and build a community.” For Olivia, the community-building facilitated by her organization was critically important for participants’ professional development.

To create community, each workshop asked participants to sit at small tables together, accompanied by teaching assistants. Olivia described how this setup engendered “peer to peer relational activity” and learning, and explained this significance for her workshop’s participants.

In the Black community, community is really important. I want you to learn who’s in this room. I want you to get to know them, because you two, if you spark or kick it off with someone you know, have a great conversation, you might want to say, hey, let’s meet up later at the coffee shop and let’s finish our portfolios.

Workshops included breaks for team-building activities and socializing over meals. The organizations offering coding workshops also often held social meetups to encourage networking beyond the educational events. Danny emphasized the necessity of building community among participants and working to change the culture of the larger Go community. He argued,

You’re not just teaching somebody a programming language on a Saturday morning;

you’re introducing them to an entirely different community and ways of talking and collaborating.

All of the workshops laid out standards for participation in their communities, but Sophie and Danny’s workshop explicitly connected their communities’ welcoming, inclusive culture to the wider language community. As users of a newly popular language, Sophie and Danny saw themselves as shaping the standards of the Go community. Danny explained how these workshops help create generational change and a culture shift within the Go community.

When I teach somebody. I’m not just teaching that one person. I’m thinking, OK, what is the impact that this person is hopefully going to have on their family and the people around them? It’s a strategic way for me to impact as many people as I can through that person. When you find somebody who can embrace that notion and they understand [that] they’re not just there for themselves, but they’re there for their community.... They take that [as they become] part of the industry ... and ideally bring others along just the same way I did for them. That has a tremendous amount of impact.

Danny understood his pedagogical role as a workshop instructor as a means to help participants learn and gain the benefits of being an early adopter of a high-prestige programming language. In doing so, he envisioned a “domino effect” where his students continue to open doors to teach for others in their communities.

Kassandra’s most meaningful takeaway from Olivia’s workshop was her relationship with two other participants. In a virtual workshop on career development and goal setting, she connected with several other women to start an accountability partners practice. As she described it, “Because we’re doing comparable journeys, it’s really helpful to compare notes.” Kassandra and her friends are working toward career transitions and provide emotional support and accountability for each other’s learning goals.

Coding workshop attendees also participated in organization Slack channels and online spaces. These online spaces facilitated community formation as participants shared experiences, asked questions, and connected over hobbies and interests. Participants often used the Slack channels to seek affirmation that their experiences with workplace discrimination were not unique.

Instead, participants banded together to vent, exchange advice, and celebrate each other's successes.

Strategy 5: Fostering Affective Literacy: In contrast with a functional literacy focusing on the syntax of programming languages, the literacy described by workshop organizers and instructors minimized the importance of content knowledge of programming languages. Although each workshop focused on a particular programming language or set of markup languages, functional literacy alone was not the central goal. Instead, workshop organizers and instructors highlighted the affective elements of literacy, pointing to the significance of self-efficacy, confidence, and feelings of empowerment in learning to code.

Writing studies researchers have considered the ways in which affect, emotion, and embodiment intersect with writing and labor [41], [42]. Lagman defines affective literacies to “describe embodied and emotional responses to texts and spaces of learning” [43, p. 5]. In my study, I take up Lagman's definition to consider how bootcamps and workshops facilitate an affective coding literacy, one that takes seriously a learner's emotional responses to texts and environments. As Julia articulated it,

The learning gains are important, but it's not going to be the same for everybody.... We want people to feel empowered. I want everyone to get out of [the workshop] whatever they can knowledge-wise, but also, feeling empowered and confident, a sense of being able to do more things than they anticipated.

Similarly, Danny argued that the most important part of coding literacy was the confidence to learn despite challenges. Danny highlighted how standards for literacy change over time as “two, three, five years down the line” there is a need to “continually learn” to maintain “relevancy and job security.” Danny described the primary literacy goals for his workshop as two-fold: first, “enough of a foundation that [participants could] self-teach,” and a student disposition characterized by a “beginner's mind” and dismissal of ego to learn the problem-solving skills needed in writing algorithms.

Coding literacy in the three case studies is affective and closely tied to learner dispositions. Literacy can be a challenging concept to define—as Brandt and others make clear, standards of literate production are constantly changing. What

constitutes a “literate programmer” or a “literate coding workshop participant” varied widely across academic, professional, and personal contexts. That is, literate action is determined by actors and institutions in a particular context. As Brandt and Clinton argue,

Literacy is neither a deterministic force nor a creation of local agents. Rather it participates in social practices in the form of objects and technologies, whose meanings are not usually created nor exhausted by the locales in which they are taken up. [44, p. 38]

Each workshop demonstrated how standards of literacy were coconstituted by both the local community of practice that “grow[s] out of a convergent interplay of competence and experience [involving] mutual engagement” as well as larger industry-wide stances [45, p. 229].

Definitions and benchmarks for what constitutes literacy also move and change over time. With her background in Library and Information Science, Ana offered a range of competing and overlapping definitions of technological literacy, tracing a scale from digital competency to digital fluency, and emphasizing the fluid nature of literacy. Ana theorized a range of expectations for what counts as digital literacy, from understanding how to use one's machine in functional ways (i.e., unzipping files, downloading software updates) to the more complex (i.e., using Excel and various software programs). The practices that constitute coding literacy change in response to the participant's needs, goals, and professional and personal contexts.

In the workshop context, coding literacy is framed as a “habit of mind” (W3), a practice of “unlearning what they've been taught” (W1), or the ability to “self-teach” (W2). Despite the differing framings of coding literacy, each workshop centered a literacy that is affective. As Danny explained

It's never just about syntax. You can learn the syntax in a couple of weeks, [but] that's not the killer feature of the community. The killer feature is if I need help, can I go into this community and ask a question and have somebody point me in the right direction?

Despite the differing framing of coding literacy, each workshop centered a literacy that is affective, where participants feel agentive, empowered, and supported by their professional community.

By understanding theorizing, teaching, and practicing an affective coding literacy that drew together “hard” and “soft” skills, organizers and instructors sought to facilitate transfer of course content and participant dispositions to other areas of the participants’ lives. Transfer is the idea that students take knowledge from one context and use it in a different context. Rather than understanding transfer as a direct application of coding skills from one context to another, workshop organizers and instructors conceived of transfer more broadly, as action closely tied to student dispositions of confidence and self-efficacy.

The relationship between student disposition and transfer is an ongoing subject of research in writing studies scholarship. Bawarshi traces the perspective “that we must cultivate students’ dispositions for transfer rather than (or in addition to) teaching them directly transferrable skills,” ultimately contending that

dispositions are not only cognitively framed, they are also situated within and shaped by sociocultural conditions that challenge us to consider more complex economies of transfer. [46, p. 91]

Instructors stressed the importance of participant dispositions of “empowerment” and “self-efficacy” as participants transfer that confidence to other technical spaces in their daily lives.

Affective literacy fostered by these case studies helped participants’ transfer and worked to increase participant’s “credibility” in industry settings. Sophie explained this phenomenon.

One thing that I learned about being in an organizational role or wearing the captain’s hat at tech events is that people estimate your Go level to be a lot higher than it actually is. By people, I mostly mean men, people who are coming from a more senior angle relative to me. What a lot of people operate by is that organizing things is hard and getting in front of other people is hard. ... to do that you must have high confidence in yourself. If you have high confidence in yourself, you must be technically capable already.

Sophie’s example reveals the conflation of affective literacy in one area, public speaking, with technical expertise, with the result of countering other engrained stereotypes about positionality and tech. For Sophie, affective literacy and the network that she developed through organizing diversity and

inclusion programs accelerated her career. Affective coding literacy is especially critical for minoritized or marginalized individuals. Byrd explains,

A curriculum that centers coding literacy as a skill rather than the holistic well-being of its students runs the risk of perpetuating disrespect of Black bodies. However, ... a coding program that tends to the affect of its adult students may help support student learning. [31, p. 43]

Byrd argues that emotional labor and affective literacy matter for the Black coding bootcamp participants at the center of his study. Much as with the coding bootcamps studied here, networks of material and nonmaterial support are critical for participants’ acquisition of coding literacy.

Kassandra, a participant in the workshop for women of color, articulated the stakes of affective coding literacy and transfer to her work on technology and equity. She came to coding from her previous work at a digital humanities nonprofit and was seeking to move into data storytelling and product design. She decided to start coding as a project manager for the nonprofit when she realized that due to funding concerns, the organization’s website wasn’t constructed to make its work publicly accessible to the people it served. Kassandra said, “I wanted the skills to fix this problem,” and explained that “There’s such a gap between this material and the interface.” This exigency led Kassandra to pursue further coding education.

Kassandra spoke at length about the relationship between coding and literacy, and the problems that accompany dismissing the affective side of coding literacy. She explained

We need to be careful as a society not to reduce coding to just the hard skill sets, because a lot of problems come from not marrying the machine understanding with human understanding In the 90s you would have computer viruses. They would get transmitted, but you [could] change the machines and make them more virus-proof. Nowadays, [for] things that go viral like fake news on social media, your transmitters are humans, and we can’t reengineer the humans.

Kassandra pushed back against narrow conceptions of coding literacy, emphasizing the necessity for affective, human-centered approaches to programming. Kassandra’s analysis supports ongoing popular and academic conversations about the role of code in perpetuating bias, harm, and

oppression [16], [48]. As an active member in many organizations for women in technology, Cassandra and her fellow participants were actively engaging this conversation in their own work.

CONCLUSION

To summarize, each coding workshop used an inclusive, culturally aware pedagogy to promote participants' coding literacy acquisition. Workshop organizers and instructors adopted five key strategies: increasing access, centering representation, facilitating active learning, cultivating community, and fostering affective literacy. Although the three case studies considered here are community organizations rather than traditional sites of TPC, I contend that this study's results have relevance for TPC teaching, research, and practice.

Implications for Pedagogy and Practice

Researchers, teachers, and practitioners can further consider the ways in which their own organizations and technologies function to encourage or restrict access, representation, and community, especially for marginalized and minoritized individuals. Teachers of TPC can center the representation of marginalized communicators and foreground issues of bias and ethics in technical communication [49]. TPC classes might partner with local coding workshops to support the organizations' technical documentation and grant-writing efforts. As digital, multimodal assignments like eportfolios are increasingly used in TPC classes, educators might consider how to encourage students' affective technological literacy and its transfer beyond the classroom.

Furthermore, understanding coding literacy as affective emphasizes the importance of human-centered design and user experience for practitioners. Attending to accessibility, representation, and users' affective responses might benefit TPC professionals. Researchers and practitioners in TPC have moved to consider the ways in which software and algorithms can amplify existing structural oppression [50]–[52]. This study reveals how marginalized individuals work to challenge existing industry-wide inequity, forwarding an affective coding literacy that offers transformative access.

Limitations This research has several limitations. First, these case studies are not necessarily representative of all coding bootcamp

and workshops. The small sample size limits arguments about generalizability. Instead, I consider how these case studies and interview participants offer generative practices for social justice work in the tech industry.

Second, although this study uses member-checking, it could do more to promote collaboration between practitioners and researchers. Agboka issued a call to action to “enact systems that magnify [research participants'] agency” [53, p.162]. One avenue to do so might involve a more dialogic, collaborative research process from the beginning of the project. Johnson Sackey argues that directly involving community members as contributors at the study design phase can allow researchers to move beyond simply translating their work to the community [54].

Suggestions for Future Research Future research might take a longitudinal approach to follow coding workshop and bootcamp participants as they transition into software development roles. Such an approach may facilitate a deeper understanding of how affective coding literacy transfers to professional contexts. Another promising avenue for future research might entail applying a similar focus on software developers with marginalized identities as they work toward more equitable technologies in their specific industries. Many participants in my larger study of sites of coding education gestured toward specific activist practices in their workplaces, suggesting that there is significant overlap between their work to increase access to coding education and their activism in their professional roles.

Finally, my study suggests several questions for future research.

- How might TPC educators and practitioners cultivate an expansive understanding of accessibility that considers learners' and users' positionalities and physical access requirements, their material contexts, and their technology needs?
- How might sites of TPC education position learners to create welcoming learning environments (i.e., challenging perceptions about knowledge prerequisites)?
- Which pedagogical approaches offer the greatest benefits for minoritized or marginalized learners?
- How might TPC instructors and practitioners center diversity, equity, and inclusion in their work?

REFERENCES

- [1] B. Obama, "2016 State of the Union Address," White House. 2016. [Online]. Available: <https://obamawhitehouse.archives.gov/the-press-office/2016/01/12/remarks-president-barack-obama-%E2%80%93-prepared-delivery-state-union-address>
- [2] A. Byrd, "‘Like coming home’: African Americans tinkering and playing toward a computer code bootcamp," *Coll. Comp. Commun.*, vol. 71, no. 3, pp. 426–452, 2020.
- [3] A. Vee, *Coding Literacy: How Computer Programming is Changing Writing*. Cambridge, MA, USA: MIT Press, 2017.
- [4] J. F. DeFranco and P. L. Laplante, "Review and analysis of software development team communication research," *IEEE Trans. Prof. Commun.*, vol. 60, no. 2, pp. 165–182, Jun. 2017.
- [5] E. Friess, "Scrum language use in software engineering firm: An exploratory study," *IEEE Trans. Prof. Commun.*, vol. 62, no. 2, pp. 130–147, Jun. 2019.
- [6] R. A. Bailee and J. Huset, "The effect of CMS technology on writing styles and processes: Two case studies," *IEEE Trans. Prof. Commun.*, vol. 58, no. 3, pp. 309–328, Sep. 2015.
- [7] N. N. Jones, K. Moore, and R. Walton, "Disrupting the past to disrupt the future: An antenarrative of technical communication," *Tech. Commun. Quart.*, vol. 25, no. 4, pp. 211–229, 2016.
- [8] A. M. Haas, "Race, rhetoric, and technology: A case study of decolonial technical communication theory, methodology, and pedagogy," *J. Bus. Tech. Commun.*, vol. 26, no. 3, pp. 277–310, 2012.
- [9] M. F. Williams and O. Pimentel, "Introduction: Race, ethnicity, and technical communication," *J. Bus. Tech. Commun.*, vol. 26, no. 3, pp. 271–276, 2012.
- [10] R. Walton, K. Moore, and N. N. Jones, *Technical Communication After the Social Justice Turn: Building Coalitions for Action* (ATTW Book Series in Technical and Professional Communication). New York, NY, USA: Routledge, 2019.
- [11] N. N. Jones, "Coalitional learning in the contact zones: Inclusion and narrative inquiry in technical communication and composition studies," *Coll. English*, vol. 82, no. 5, pp. 515–526, 2020.
- [12] N. N. Jones, "The technical communicator as advocate: Integrating a social justice approach in technical communication," *J. Tech. Writing Commun.*, vol. 46, no. 3, pp. 342–261, 2016.
- [13] N. N. Jones and R. Walton, "Using narratives to foster critical thinking about diversity and social justice," in *Key Theoretical Frameworks: Teaching Technical Communication in the Twenty-First Century*, A. Haas and M. Eble, Eds. Logan, UT, USA: Utah State Univ. Press, 2018, pp. 241–267.
- [14] E. Beck, "A theory of persuasive computer algorithms for rhetorical code studies," *Enculturation*, vol. 23, 2016.
- [15] K. Brock, *Rhetorical Code Studies: Discovering Arguments in and Around Code* (Sweetland Digital Rhetoric Collaborative Series). Ann Arbor, MI, USA: Univ. Michigan Press, 2020.
- [16] S. U. Noble, *Algorithms of Oppression: How Search Engines Reinforce Racism*. New York, NY, USA: New York Univ. Press, 2017.
- [17] L. Potts, L. Gonzales, H. Turner, L. Brentnell, G. Bottomley, and L. Dyson, "Ladies that UX: leadership and organization report," white paper, Writing/Information/Digital/Experience, (WIDE Research Center), Michigan State Univ., East Lansing, MI, USA, 2017.
- [18] S. Baniya, L. Hutchinson, A. Kumari, K. Larson, and C. Lindgren, "Representing diversity in digital research: Digital feminist ethics and resisting dominant normatives," in *Proc. Annu. Comput. Writing Conf.*, 2018, pp. 1–7.
- [19] E. J. Petersen, "The ‘Reasonably Bright Girls’: Accessing agency in the technical communication workplace through interactional power," *Tech. Commun. Quart.*, vol. 28, no. 1, pp. 21–38, 2019.
- [20] S. D. Williams, G. Ammettler, I. Rodriguez-Ardura, and X. Li, "Narratives of international women entrepreneurs: An exploratory case study of identity negotiation in technology startups," *IEEE Trans. Prof. Commun.*, vol. 63, no. 1, pp. 39–51, Jan. 2020.
- [21] K. White, S. K. Rumsey, and S. Amidon, "Are we ‘there’ yet? The treatment of gender and feminism in technical, business, and workplace writing studies," *J. Bus. Tech. Commun.*, vol. 46, no. 1, pp. 27–58, 2016.
- [22] M. A. Beasley and M. J. Fischer, "Why they leave: The impact of stereotype threat on the attrition of women and minorities from science, math and engineering majors," *Soc. Psychol. Educ.*, vol. 15, pp. 427–448, 2012.
- [23] R. Duffner, "The rise of the coding boot camp," 2014. [Online]. Available: www.wired.com/insights/2014/08/rise-coding-boot-camp/
- [24] PR Newswire, "LivingSocial launches ‘Hungry Academy’ to train next generation of software development champions," Dec. 21, 2011. [Online]. Available: www.prnewswire.com/news-releases/livingsocial-launches-hungry-academy-to-train-next-generation-of-software-development-champions-135994418.html
- [25] G. A. Wilson, "Could a coding bootcamp experience prepare you for industry?," *IT Prof.*, vol. 20, no. 2, pp. 83–87, 2019.
- [26] Coding bootcamps in 2020. Course rep. 2020. [Online]. Available: <https://www.coursereport.com/2020-guide-to-coding-bootcamps-by-course-report.pdf>
- [27] M. Pronschinske, "Boot camps won’t make you a coder: Here’s what will," Jan. 2020. [Online]. Available: www.techbeacon.com/app-dev-testing/bootcamps-wont-make-you-coder-heres-what-will-0
- [28] P. Pathak. (2016 Aug.). Are coding bootcamps only for the rich? [Online]. Available: www.techcrunch.com/2016/08/06/are-coding-bootcamps-only-for-the-rich
- [29] D. Brandt, "Sponsors of literacy," *Coll. Comp. Commun.*, vol. 49, no. 2, pp. 165–185, 1998.
- [30] A. J. Banks, *Race, Rhetoric, and Technology: Searching for Higher Ground* (NCTE-LEA Res. Ser. Literacy Comp.). Mahwah, NJ, USA: Lawrence Erlbaum, 2006.
- [31] A. Byrd, "Between learning and opportunity: A study of African American coders’ networks of support," *LiCS*, vol. 7, no. 2, pp. 31–55, Nov. 2019.

- [32] K. Crenshaw, "Demarginalizing the intersection of race and sex: A Black feminist critique of antidiscrimination doctrine, feminist theory, and antiracist politics," *Univ. Chicago Legal Forum*, vol. 1, no. 8, pp. 139–167, 1989.
- [33] K. A. Scott and P. Garcia, "Techno-social change agents: Fostering activist dispositions among girls of color," *Meridians, Feminism, Race, Transnationalism*, vol. 15, no. 1, pp. 65–85, 2016.
- [34] K. R. Moore, "The technical communicator as participant, facilitator, and designer in public engagement projects," *Tech. Commun.*, vol. 64, no. 3, pp. 237–253, 2017.
- [35] Labor Force Statistics from the Current Population Survey. 2021. [Online]. Available: <https://www.bls.gov/>
- [36] C. Urquhart, *Grounded Theory for Qualitative Research*. London, UK: Sage, 2013.
- [37] J. Saldaña, *The Coding Manual for Qualitative Researchers*. London, UK: Sage, 2016.
- [38] D. Brandt, *The Rise of Writing: Redefining Mass Literacy*. New York, NY, USA: Cambridge Univ. Press, 2015.
- [39] O. Mironova, I. Amitan, J. Vilipold, M. Saar, and T. Rütmann, "Computer science e-courses for students with different learning styles," in *Proc. Federated Conf. Comput. Sci. Inf. Syst.*, 2013, pp. 735–738.
- [40] J. L. Duffany, "Application of active learning techniques to the teaching of introductory programming," *IEEE Rev. Iberoamericana Tecnol. Aprendizaje*, vol. 12, no. 1, pp. 62–69, Feb. 2017.
- [41] M. Rose, *Lives on the Boundary: The Struggles and Achievements of America's Educationally Underprepared*. New York, NY, USA: Penguin Press, 1989.
- [42] C. Prendergast, "Reinventing the university: EUI as writing initiative," *Learn. Teach.*, vol. 6, no. 3, pp. 79–88, 2013.
- [43] E. Lagman, "Moving labor: Transnational migrant workers and affective literacies of care," *Lit. Comp. Studies*, vol. 12, no. 3, pp. 1–24, 2015.
- [44] D. Brandt and K. Clinton, "Limits of the local: Expanding perspectives on literacy as a social practice," *J. Lit. Res.*, vol. 34, no. 3, pp. 337–356, 2002.
- [45] E. Wenger, *Communities of Practice: Learning, Meaning, and Identity*. New York, NY, USA: Cambridge Univ. Press, 1998.
- [46] A. Bawarshi, "Economies of knowledge transfer and the use-value of first-year composition," in *Economies of Writing: Revaluations in Rhetoric and Composition*. B. Horner, B. Nordquist, and S. M. Ryan, Eds. Logan, UT, USA: Utah State Univ. Press, 2017, pp. 87–98.
- [47] V. Eubanks, *Automating Inequality: How High-Tech Tools Profile, Police, and Punish the Poor*. New York, NY, USA: Picador, 2018.
- [48] C. O'Neil, *Weapons of Math Destruction*. New York, NY, USA: Broadway Books, 2016.
- [49] C. D. Shelton, "Shifting out of neutral: Centering difference, bias, and social justice in a business writing course," *Tech. Commun. Quart.*, vol. 29, no. 1, pp. 18–32, 2020.
- [50] S. Amrute, "Bored techies being casually racist: Race as algorithm," *Sci. Technol. Human Values*, vol. 45, no. 4, pp. 903–933, 2020.
- [51] L. Petrucci, "Theorizing postfeminist communities: How gender-inclusive meetups address gender inequity in high-tech industries," *Gender Work Organiz.*, vol. 27, no. 4, pp. 545–564, 2020.
- [52] A. Shivers-MacNair, L. Gonzales, and T. Zhyvotovska, "An intersectional technofeminist framework for community-driven technology innovation," *Comput. Comp.*, vol. 51, pp. 43–54, 2019.
- [53] G. Y. Agboka, "Subjects' in and of research: Decolonizing oppressive rhetorical practices in technical communication research," *J. Tech. Writing Commun.*, vol. 34, no. 1, pp. 159–174, 2020.
- [54] D. Johnson Sackey, "Black technical and professional communication," Nov. 2020. [Online]. Available: <https://vtechworks.lib.vt.edu/bitstream/handle/10919/101571/BlackTechComm%20Transcript.pdf?sequence=6&isAllowed=y>

Ashley Rea received the bachelor's degree in English and Economics from Texas Christian University, Fort Worth, TX, USA, in 2015; the master's degree in Rhetoric and Composition from Florida State University, Tallahassee, FL, USA, in 2017; and the Ph.D. degree in Rhetoric and Composition from Penn State University, University Park, PA, USA, in 2021. She is currently an Assistant Professor of rhetoric and composition with Embry-Riddle Aeronautical University, Prescott, AZ, USA. Her research focuses on equity, technology, and writing studies, and has appeared in *Technical Communication*.