



Holding a Safe Space with Mutual Respect and Politicized Trust

Essentials to co-designing a justice-oriented high school curricular program with teachers

Gayithri Jayathirtha
gayithri@uoregon.edu
University of Oregon
Eugene, Oregon, USA

Gail Chapman
chapgail@gmail.com
Exploring Computer Science
Eugene, Oregon, USA

Joanna Goode
goodej@uoregon.edu
University of Oregon
Eugene, Oregon, USA

ABSTRACT

Continued and amplified harm to marginalized communities by computing solutions is pushing computing education to orient towards justice. Resisting harm requires elevating teacher voices within curricular design. We partnered with twelve high school teachers to co-design and revise an existing introductory computing program. We qualitatively analyzed post-co-design teacher interviews to answer the following: (1) How did teachers perceive their involvement in curricular design? (2) What design aspects of the curricular revision did teachers identify as important to participate as co-designers? (3) What design features supported or challenged teacher participation? Being involved in co-design made teachers feel valued and respected rather than deprofessionalized. Holding a safe space with politicized trust was key to their participation, and opportunities to reflect, share, and listen from diverse perspectives were essential. Policies around curricular design work should emphasize empowering trusting teacher communities to advance justice-oriented goals within computing education.

CCS CONCEPTS

• **Social and professional topics** → **K-12 education**.

KEYWORDS

Curricular co-design, high school teachers, equitable co-design, secondary computing education

ACM Reference Format:

Gayithri Jayathirtha, Gail Chapman, and Joanna Goode. 2024. Holding a Safe Space with Mutual Respect and Politicized Trust: Essentials to co-designing a justice-oriented high school curricular program with teachers. In *Proceedings of the 2024 RESPECT Annual Conference (RESPECT 2024)*, May 16–17, 2024, Atlanta, GA, USA. ACM, New York, NY, USA, 9 pages. <https://doi.org/10.1145/3653666.3656090>

1 INTRODUCTION

As computing deeply penetrates different aspects of our daily lives—from public surveillance to health care [3, 5, 7]—one cannot ignore its connections to people, communities, and societies within computing education. Recent educational design, research, and policy efforts have pushed for integrating justice-related issues, such as racism, sexism, classism, and ecology, with computing. Aligned

theoretical frameworks [14, 30], curricular and pedagogical frameworks [6, 18, 21], and approaches to computing teacher education programs [17] call for a non-neutral treatment of computing within K-12 computing education. While small-scale interventions such as individual lessons and units have been designed towards justice-oriented computing [29], large-scale efforts such as introductory high school programs and associated teacher professional development (PD) programs are only now emerging.

Among equitable approaches to designing educational interventions, participatory design research is one where community members, for whom the designs are consequential to their daily lives, are included as participants in the design process—a way to disrupt the normative power dynamics between the researchers and "researched" and "create new roles and relations towards transformative ends" (p. 173, [2]). By drawing from critical theories, participatory design research emphasizes bringing about material changes to the lives of marginalized community members through the designed interventions. Collaborative design or co-design is part of the family of participatory design research, which brings different community members such as teachers, researchers, and designers together while "leveraging the expertise of teachers to design, implement, and test educational innovations and thereby expand teachers' agency within reform efforts" (p. 532, [27]). Countering the increasing resistance that teachers face to adopting any justice-oriented program within local political contexts in the U.S. [26] and their deprofessionalization within educational systems [24], co-designing curricular innovations with teachers includes their personal and classroom experiences and expertise in the design process. Co-design processes and interventions can potentially elevate teachers' voices, a source of knowledge marginalized within research, design, and policy. Recent efforts have raised concerns about educational justice and power relations in collaborative design efforts [25]. And yet, across research studies, teacher perceptions about the meaning and importance of their participation as co-designers are barely explored. Also missing from the research literature are productive ways to design co-design spaces that ensure equitable engagement of teachers as co-designers.

Our work focuses on centering teachers' voices and perspectives while redesigning an existing introductory high school computing program. While the majority of the previous efforts involving teachers as co-designers highlight how co-design sessions serve as opportunities for teacher learning [15] and effective implementation of curricular interventions [33], recent research has explored teacher agency and empowerment [22, 27]. Design principles such as teacher solidarity co-design [24, 25] have highlighted the need to carefully consider power relations that shape teachers' participation in co-design efforts and aspects that may constrain their



This work is licensed under a Creative Commons Attribution-NonCommercial-NoDerivs International 4.0 License.

RESPECT 2024, May 16–17, 2024, Atlanta, GA, USA
© 2024 Copyright held by the owner/author(s).
ACM ISBN 979-8-4007-0626-4/24/05
<https://doi.org/10.1145/3653666.3656090>

participation. It calls for attention to the power relations between teachers, researchers, and designers as they work towards designing curricular interventions, particularly with commitments towards educational justice. Such considerations become all the more significant when computing teachers, in the past, have struggled to have conversations at the intersections of race and computing [10]. We qualitatively, inductively, and collaboratively analyzed teacher post-co-design interviews [8, 28] to answer the following questions: (1) How did teachers perceive their involvement in curricular design? (2) What design aspects of the curricular revision did teachers identify as important to participate as co-designers? (3) What design features supported or challenged teacher participation?

2 THEORETICAL FRAMEWORK

Our work with teachers as co-designers of justice-oriented curricular programs is informed by existing work within three areas of inquiry: justice-oriented computing education, co-designing with teachers, and designing co-design opportunities with teachers toward justice-oriented curricular programs.

2.1 Justice-oriented K-12 computing education

A push for justice-oriented K-12 computing education draws from recent research exploring technologies that shape everyday lives by aiding public surveillance and criminal justice systems [1, 3, 5, 7]. Computing educational initiatives are reckoning with computing and its intersections with justice-related issues, especially how they center such connections within pedagogical approaches [21], curricular resources [17, 30], and design of learning environments [6, 14]. Across these efforts is a call to curb the neutral treatment of computing concepts and actively engage with their connections with social aspects. For instance, Kapur's culturally responsive-sustaining computer science education framework argues for pedagogical practices that encourage sociopolitical critiques of technologies and their designs while acknowledging racism in computer science and enacting anti-racist practices within classrooms [6]. Along similar lines, Kafai and Proctor [14] call for the adoption of critical framing within K-12 computing education that views "learning as developing an understanding of how realities are shaped and emphasizing strategies for resisting marginalization and oppression" (p. 147).

Critical theoretical frameworks have led to designing and implementing courses within postsecondary contexts that explore ethics and disciplinary intersections [4], which support learners in exploring issues such as data privacy and other social impacts of computing. An exception is the Race, Gender, and Computing course [32] that explicitly engages learners with sociocultural aspects of computing in postsecondary contexts. Nevertheless, contrary to the calls by the frameworks discussed above, most other approaches have the pitfall of turning colorblind by not explicitly addressing contentious issues such as racism [30]. Educational interventions, both for learners and teachers, need to explicitly engage with computing as it interacts with different dimensions of oppression and is colored by colonialist, racist, hetero-normative, sexist logics [1, 3, 7]. While examples of semester-long projects that engage learners with computing critically exist [29], there is a need for a robust set of curricular resources and associated teacher supports in the form of PD and teacher education programs to orient computing towards

justice, particularly within the numerous K-12 classrooms which introduce learners to the discipline for the first time [17].

2.2 Teachers as co-designers

An equitable way to design curricular resources and PD programs is to co-design them with teachers, drawing from their classroom experiences and expertise [2]. Engaging teachers as co-designers is considered a special case of participatory design research, given the professional challenges and positionality of teachers in relation to educational design work [25]. While teachers can potentially bring in a wealth of experience and wisdom, design efforts barely consider their perspectives due to several constraints such as the perceived social value of the profession [24] and the busy schedule of teachers [16]. However, there is potential for rich engagements and design opportunities with teachers from diverse teaching-learning contexts if co-design spaces can be sensitive to teachers' needs within ever-changing local and political contexts.

Although recent within computing education, co-designing with teachers has been adopted as a design approach towards equity (e.g., [20]). Including teachers in design efforts brings classroom experiences to the forefront, creating opportunities for teacher learning and a more comfortable adoption of designed artifacts [15, 27, 33]. Additionally, approaches such as teacher solidarity co-design highlight the need to work towards educational justice while explicitly attending to the power relations that teachers navigate professionally and the relationships with communities and families they are enmeshed within while making room for mutual learning between teachers, researchers, and designers [25]. Such work should not only include teachers for what they can contribute but also make a material difference against deprofessionalization of teachers by "highlighting teaching as a complex practice that requires growth over time" (p. 9) and one that impacts the student lives by shaping their employment opportunities, having a potential to either reproduce or transform societies [24].

2.3 Designing co-designing

Despite calls to include teachers as co-designers towards educational justice, studies that have explored aspects or features of co-design spaces that support such participation are rare. So are studies that have enacted and examined design features for their affordances and challenges for teacher participation as co-designers. We know that researchers and designers have reflected on intentionally setting up technical infrastructure for co-design spaces to align with tools teachers use daily within schools and classrooms and making research language accessible for teachers [19]. In addition, studies that examined co-designing computational thinking units with biology teachers noted the need for flexible modes of engagement with teachers, openness to changing roles and responsibilities among researchers and teachers, and accommodative of their classroom commitments [16]. However, except in Philip and colleagues' work [25], we know very little about supporting teachers to contribute to educational justice projects in the current political climate, where changing needs in their local contexts force teachers across the nation to adapt teaching at the intersections of politics and STEM disciplines like computing [26]. Such co-design work requires explicit acknowledgment of the political nature of

the work in addition to all the support in the previously discussed studies. Co-design spaces should actively work against the deprofessionalization of teachers while transforming their practice, enable teachers to acknowledge the power relations undergirding educational justice work, and bring in connections between student communities and families [25]. However, more must be known about designing co-design spaces for teachers to engage in educational justice within K-12 computing education.

3 POSITIONALITY STATEMENTS

All three authors were facilitators of the co-design sessions. The first author identifies as a cis-woman researcher from South Asia (India). Two other authors, identifying as White cis-women, were the original designers of the introductory computing program redesigned in this study. Further, the second author facilitated several teachers' PDs within this introductory program in partnership with and as a mentor for seven of the twelve co-design teachers in their first years of facilitating PDs. She had met each co-design teacher at least once in-person before this co-design work began in Fall 2022. As a curriculum designer and researcher, the third author had also developed a long-standing relationship with all the teachers teaching this introductory high school program. Both the curriculum designers met the co-design teachers regularly during the annual facilitator workshop, taking some of these relationships back over a decade (depending on the duration of teacher engagement with the program; more details below). All three authors were motivated by their teaching and learning experiences within computing to lead this co-design work. In particular, the original designers of the program were also high school teachers in the past, which motivated the team to co-design the program with teachers.

4 METHODOLOGY

4.1 Context and participants

We conducted the study as a part of the Exploring Computer Science (ECS) curriculum redesign effort. ECS is an introductory computing high school program (<https://www.exploringcs.org/>). The program has a yearlong curriculum and a two-year teacher PD [11]. The curriculum comprises six required units: HCI, problem-solving, web design, programming, computing and data analysis, and robotics, with two additional elective units—electronic textiles and artificial intelligence. Each unit has lessons and activities, in total spanning across two semesters (see Table. 1 for an overview). The program supports teachers with PD sessions, including two summers of weeklong and quarterly sessions throughout the first year of teaching. Experienced teachers within the ECS community nationwide facilitate the PD sessions for new teachers. Previous studies have shown that the two-year PD structure has led to building a robust teacher community around the program [11]. Of relevance to this study, the PD facilitation model has also led to the development of a facilitators' community among experienced ECS teachers who regularly facilitate PDs locally and nationally [23].

All participants in ECS PD engage in conversations about race and gender, spurred by reading the book *Stuck in the Shallow End* [10, 12]. With participants expected to attend the first summer followed by four quarterlies and a second summer session, they are

Table 1: Required ECS curriculum units and descriptions

Unit	Description
HCI	Introduction to computers, its applications to visualize data and program
Problem-solving	Steps of problem-solving, and algorithms as problem-solving with computers
Web design	Use of HTML and basic CSS; introduction to user interface elements
Programming	Event-driven programming using Scratch programming environment
Computing and data analysis	Basics of data practices such as collecting data and generating visualizations
Robotics	Programming Edison robot using EdWare programming language

experienced in having race-related conversations at least twice every time they facilitate a PD program [11]. Further, as part of their preparation to be facilitators, they learn how to guide these conversations and commit to deepening their understanding of the issues surrounding leading such conversations in diverse geographical areas. In addition to having many opportunities to facilitate across different political contexts in the U.S. over the years, they also meet annually at the Annual Facilitators' workshop to discuss challenges and successes as facilitators and review research conducted by our team during that year. In recent years, they have been involved in leading PDs in unfavorable political contexts, and these contexts have been a point of dialogue during these annual meetings.

Although the second and the third authors have incrementally revised the program with minor changes, such as updating missing links to tools or media resources, they decided to pursue a major overhaul the program in Fall 2022, fifteen years after designing the curriculum. They approached the ECS teacher facilitators who had met in the summer 2022 to serve as co-designers [9]. The revised version of the program—curricular resources and the teacher PD—aims to include recent discourse within computing and orient the program towards justice. In 2022, twenty-one teachers scheduled to facilitate ECS PD the following summer participated in the annual ECS facilitator workshop. At the end of the workshop, the second and the third authors asked anyone interested in participating in the ECS refresh co-design to add a sticky note to a large poster placed on the board during the workshop. Of the fourteen volunteers, twelve agreed to engage long-term as co-designers. Teacher facilitators came from diverse geographic locations and teaching contexts with various teaching and facilitating experiences (see Table. 2 for details drawn from teachers' pre-co-design interviews during Fall 2022).

The authors designed a series of eight co-design sessions, spread across the academic year 2022-23, to explore computing, its social and cultural dimensions and systems of oppression, inspired by the Cultural Competence in Computing program [32]. Each session involved teachers going through pre-work and participating in a synchronous online session. Pre-work involved co-designers and the researchers reviewing a set of 3-4 short, multimodal materials

such as news articles, videos, and podcast episodes about the topic (Fig. 1) and preparing a synthesis slide reflecting on the materials (see Fig. 2 for an example). Synchronous sessions (90 min) included multiple rounds of whole and small group discussions reflecting on the pre-work and potential ideas for curricular and teacher PD resources. Teachers took notes of their ideas to reference and expand upon while writing and revising lessons and activities.

4.2 Data collection and analysis

Post-co-design teacher interviews (~45 min) were the primary data source for this analysis. The teachers were interviewed on-line within a month after the last co-design session in May 2023. We asked teachers about their experience being a part of the year-long design process, their takeaways, and their perspectives on the different design aspects of the co-design space.

The first two authors analyzed the interview transcripts qualitatively and iteratively to inductively generate themes [8] in response to the research questions posed (see Tab. 3). For each question, the two authors went through the complete transcript of all teacher interviews multiple times, highlighted related teacher utterances, generated *in-vivo codes* using the same teachers' language, and discussed emergent themes until a consensus was reached [8]. Throughout, the authors reflected on their relationship with the teacher facilitators and their experience during the co-design sessions and contextualized the themes to develop detailed descriptions and interpretations. Existing longitudinal relationships between the second author and the teachers helped both authors analyze data with cognitive empathy while understanding their interview responses concerning their professional and personal contexts [28]. Further, the themes were discussed with the third author to contextualize them within the existing literature on teachers as professionals and as co-designers.

5 RESULTS

We found that teachers felt valued and empowered professionally as they engaged in the curricular co-design work. They reflected on how the co-design experience supported their personal growth in addition to the more obvious professional gains. At the same time, they highlighted the significance of doing this work with a teacher community with mutual respect and politicized trust. Teachers shared how they intentionally moderated their participation to hold a safe space for all teachers to engage equitably. Teachers identified features of the co-design sessions that enabled their participation by affording opportunities for reflection, sharing, and listening from teachers from diverse political and teaching contexts. However, some teachers shared the need for more explicit expectations and to invest more time in community development to support teachers as co-designers towards justice-oriented computing programs.

5.1 "Many curricula would just change:" Teacher perspectives as co-designers

Overall, teachers felt like they were valued professionally. They articulated specific ways in which participating as co-designers pushed against the deprofessionalization they experienced as teachers in other parts of the educational system. In addition to the professional growth already articulated in existing literature, teachers

discussed different dimensions of personal growth they experienced as they co-designed the program: they reflected on their identities and took these topics beyond the curricular design to make it a part of other aspects of personal lives.

All the teachers expressed how they felt valued and visible by participating as curricular co-designers. As Floresa, a Black female teacher teaching in an urban West Coast city, shared how she "felt valued... [and she] can't believe somebody wants me to be a part of [curricular redesign]." The teachers felt responsible for their students and other ECS classrooms nationwide as they designed the program. They shared how they were "voices of the ECS teacher community" (Maria, another Black female teacher from a large, mid-west urban city) contributing through their classroom and personal experiences. A similar sentiment was echoed in Taylor's sharing that "small changes that they were making in their classroom [were] creating these bigger changes out in the world, like timing those kinds of conversations with what other people are doing across the U.S. and like their ECS classrooms felt very inspirational."

Some teachers further expressed this as an opportunity to experience outside of what they traditionally experience as teachers. For one, being invited to be a part of a curricular design itself was seen as a step against "many curricula [that] would just change" and then informing teachers of the changes (Elaine, a White female teacher from an East Coast suburban town). Elaine shared how being involved as co-designers meant valuing teachers' experiences in the face of top-down decision-making, such as canceling the computer science courses they teach since the schools "still don't care about computer science sometimes." On the contrary, she pointed out how co-designing made room for "reflection, which we know is very important" for teachers' practice, especially for a veteran teacher like her who has been teaching the course and facilitating teacher P.D.s for over ten years. Particularly about the materials provided, Kristi shared that she felt treated with respect and dignity by being presented with "challenging texts [instead of getting] the watered down version from whatever news source, but to really actually try to understand what is happening mathematically or scientifically, in the background." Highlighting the political power of the profession [24], Elaine continued to share how co-designing the justice-oriented program resonated with her views that "if we are teaching to current students who are going to have a voice in their world as leaders, then systemic racism and how it relates to computer science must be addressed."

The sentiment of valuing their profession and its different complexities was evident in how teachers appreciated not being forced to quickly produce lessons or similar educational units/artifacts. Kristi noticed how the co-design approach was counter to her experience as an educator who's "constantly like, up against time and having to generate something that hasn't been an objective, and you've got to spit it out for tomorrow." She shared how co-designing sessions were an opportunity to "slow down just a bit" and think more closely about computing concepts and their connections to justice issues. Similarly, Libbyada, a novice ECS facilitator, shared that she "really appreciated the pre-work, going through the resource ahead of time." John, a novice facilitator but an experienced ECS teacher, acknowledged the time the process gave for "this is an ongoing process... to learn more and grow more as time goes."

Introduction	Colonialism	Racism	Gender & Sexuality	Socio-economic class	Ableism	Environment & Ecology	Towards curriculum redesign
- Name activity - Identities & computing teaching & learning	- Tech Colonialism Today - Native Americans debugging AI biases	- Fighting Racial Bias in Algorithms - CS has a racism problem	- Traveling while trans - How biased are our algorithms?	- Automating Inequity: Red Flags - AI & the rise of economic inequality - The wrong side of the digital divide	- Can you make an AI that isn't ableist? - A difficult different discrimination: AI & disability	- Google's carbon emission doubled - Cobalt mining for batteries at a high human cost - The global cost of electronic waste	Kapor Center Curricular Developer Assessment tool

Figure 1: Co-design session series showing a subset of pre-work materials

Table 2: Teacher Details (arranged in descending order of facilitator experience years)

Teacher name (as preferred by the teachers)	Racial and gender identities	ECS teaching experience (years)	ECS facilitating experience (years)	U.S. geographical location	Student ethnic composition in descending order
Don	White, male	11	11	Midwest urban	South Asian, Latinx, Black, and White
Elaine	White, female	11	8	East coast suburban	Mostly White, under 10% marginalized communities
Floresa	Black, female	11	7	West coast urban	Mostly Black
Kristi	White, female	7	6	East coast urban	Latinx, Black, Asian
Maria	Black, female	10	5	Midwest urban	Black, Latinx, White
Tangela	Black, female	5	4	South rural	Black, White, Asian Indian
Taylor	White, female	5	2	Midwest urban	Latinx, Black, White
Taghrid	Middle-eastern, female	5	2	West coast suburban	White, Latinx
Libbyada	Black, female	5	1	South rural	Black, Latinx
Kerri	White, female	3	1	East coast suburban	White, Black
Jennifer	White, female	5	0	Midwest urban	All Black
John	White, male	8	0	West coast suburban	Latinx, Black, White, Polynesian

Some teachers explicitly mentioned how co-designing was not just an obvious opportunity for professional growth but also for personal growth, as educators, to reflect and learn from one another. Elaine shared that going through different topics within co-design sessions and reflecting on potential ideas for lessons and P.D. enabled her to "work on [her] own identity, and then helping students work on their own identities so that they have something to bring to the table and relate to." Teachers making connections to their own identities were prominent in Tangela's, a Black teacher from a Southern state, sharing: "I am geographically in the south, I mean, I could relate to a lot of things" or in what Don shared about these sessions as enabling him to "bring up these topics as a White male in front of a classroom of [sic] wide diversity of students" while also reflecting on "how will that come across to [his] students."

Taghrid, a first-generation immigrant to the U.S. and a novice facilitator reflected on the different topics discussed during co-design concerning her background and shared how "I didn't study U.S. history as a student not growing in the United States... [some topics] were totally completely new to me." Kristi further shared how working through the co-design sessions helped her expand beyond brainstorming curricular ideas and instead develop "the practice of saying, what does gender identity look like in these spaces? And beyond just this curriculum? What does it look like in my school?" Libbyada further shared about co-designing enabling her to "[reflect on] our own life, or what are we dealing with in our classroom or just in the community with stakeholders," as she shared that topics of ableism discussed during one of the co-design sessions got her to be mindful of "prejudging [people] of what they can do

Maria – Session 2

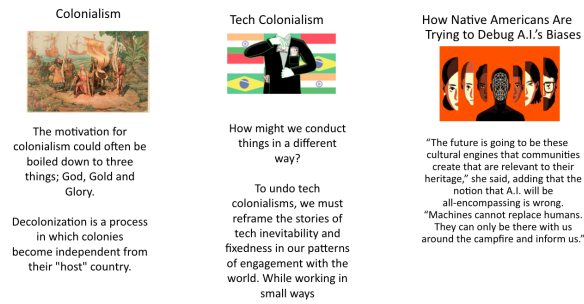


Figure 2: Maria's synthesis slide

Table 3: Emergent themes and sub-themes in response to research questions

RQ#	Theme	Sub-themes
1	Teacher perspectives	Feeling valued; Push against deprofessionalization; Experiencing personal growth
2	Teacher needs	Mutual respect; Politicized trust
3	co-design design features	Opportunities to reflect, share, and listen from diverse perspectives Need for explicit instruction and time for community building

and what they can't do.. [since we] don't know how much physical or health-wise issues they're dealing with," in her everyday life.

Participating in co-design meant being valued, professional elevation, and personal growth about justice-related topics.

5.2 "I knew it was a safe space:" Needs of teacher co-designers

Unlike many other curricular co-design work [15, 16], the work studied here required teachers to have hard conversations about race and gender, something that earlier research has pointed out as teachers across experience levels struggle with [10]. Unsurprisingly, teacher interviews highlighted that creating a space with mutual respect, particularly one with politicized trust, was quintessential for teachers to serve as co-designers of a justice-oriented program. As they engaged in the work, teachers sensed the need for mutual respect and trust and modified their participation to create a safe space for everyone to participate.

The co-design teachers in this study were noted, across multiple points, trying to sense the space in relation to the contentions topics at hand before engaging with other co-designers. Both veteran and novice facilitator teachers sensed others' positions on topics before engaging in group discussions. Before entering the synchronous meetings, teachers took the opportunity of the shared space created with synthesis cards to sense the room. For instance, Libbyada, a novice facilitator, shared that pre-work "gave us some time to

collaborate and share our thoughts on different parts of it... brought to light our thought process on the different subject matters that were at hand." Along similar lines, Taghridd, another novice facilitator, shared how she would "try to read whatever synthesis cards had been compiled by other participants... [for] it gave kind of an idea about the different viewpoints or different looks on the same subject for somebody else." Even experienced teachers took time to sense the room before engaging. For instance, Kristi said she would take time before the synchronous meetings to review the cards and see "how the room was thinking about these topics." In discussing his participation during synchronous sessions, Don shared, "I was very passive in the conversations... I was wondering about how teachers would, you know, perceive what we're doing or their willingness to accept it."

Teachers in this group consistently shared the significance of the trust among the group members—between teachers and teachers and original program designers. For instance, Maria shared: "I know that [the original designers] enjoy the honest and true feedback from individuals that are actually teaching it and have experienced, you know, the lessons and, and think about ways in which we could level up like our current needs." Elaine's trust in the design team was visible in how she related to the original designers and the researchers in the space: "I always learned so much when I'm with [you three]." Such trust was crucial to establishing a safe space with "some sense of security around like, Okay, we all know, we all get it... it felt more comfortable to be around them and to have these conversations" (Kristi). As Taylor shared, she appreciated a "safe space to be vulnerable or have those difficult conversations" while brainstorming justice-oriented computing lessons and activities. Such a space, she said, was significant since "it wasn't always like a joyous conversation. But it was a conversation that, for the most part, [she] felt comfortable." John shared a similar sentiment that "that's incredibly important for any of this work to be done, we have to have a productive and safe space."

The need for safe space also required that teachers have politicized trust, to leverage the trust to have race-conscious conversations [31], something they shared as everyone having a common understanding of working towards equity within CS education. As Don shared, "We kind of speak the same language. And we have, assuming we all have the same shared mission and values, or at least vision." John shared how such shared values explicitly helped have conversations about these sensitive topics: "Because of the highly charged and somewhat sensitive nature of the topic that we are dealing with, the idea that we're all coming from the same space, as far as ECS curriculum is concerned, we all knew that we're kind of looking at it in the same direction," pointing at the repeated reading of texts such as *Stuck in the Shallow End* [12] as a part of facilitating ECS teacher PDs. Teachers appreciated the safe space where people could share and listen without being mistaken. Maria shared that she "knew that it was a safe space. And if I had questions, I had no problems like leaning on them for their expertise or getting their point of view if I was unclear; [it] just gave me comfort." Tangela also highlighted how having this safe space was essential to even getting into these contentious conversations sooner in work: "Since everyone else was like me, you know, we knew we were more willing to share, more willing to learn from each other and more willing to have those deep conversations right

off the start," or how Don shared that "It made it easier for me to talk and share, and, you know, be vulnerable."

Teachers moderated their participation themselves to create this co-design space for everyone. As Taylor said, at times, her "role was to sit back and listen to other people and their experiences and what they had to say because certain topics were more personal for them." Taghrid also mentioned how "sometimes [she] would be too hesitant to talk just because [she hasn't] experienced some of the biases or the effects of these biases, while other teachers experience them personally." On the other hand, Tangela, a Black female teacher, mentioned, "We were more willing to share, more willing to learn from each other and more willing to have those deep conversations right off the start," pointing out how she would not hesitate to share in this space, but at the same time being mindful of not being "the one with the heavy conversations all the time." Holding such a space made it easier for teachers to discuss their practice and bring it into the curricular co-design space, for, as Don shared, "assuming we all have the same shared mission, and values, or at least vision... there's an opportunity for us to have meaningful conversations about what we do and why we do things, the decisions we make in the classroom."

In summary, while teachers emphasized the need for mutual respect and politicized trust to engage as co-designers of justice-oriented programs, existing relationships between teachers in this group also meant that teachers intentionally moderated their participation to hold that safe space for everyone to participate.

5.3 Opportunities for reflecting, sharing, and listening: Co-design design features

Teachers noticed and appreciated the explicit designing of opportunities for teacher co-designers, or in Elaine's words, "intentionally support teachers to make a difference." Teachers appreciated having several opportunities to reflect, share, and listen across the different aspects of the co-design process, such as pre-work and synchronous meetings. Seen in John's sharing that these sessions allowed for "a lot of introspection of what [his] practices are, and learning about what other people's practices are... that's changed some of [his] practices." However, teachers felt initially challenged to understand their role and expectations in the design process, primarily since it differed significantly from their prior professional commitments.

Teachers appreciated the opportunities, spread across the pre-work and synchronous sessions, to reflect on their experiences and teaching practices. Libbyada, Kristi, Taylor, and most other teachers explicitly appreciated the time between sessions to process the materials, meet with other teachers during the synchronous session, make synthesis cards, and see each other to read the room, helping establish trusting relationships between co-design teachers. Teachers also saw co-design sessions and the pre-work as opportunities to reflect on their identities (discussed above) and how that may relate to their computing teaching. As Elaine shared, "When we're teaching our new teachers [during PDs], that it is going to be their ability to be reflective, and now [with the revised program] to be reflective in their own identity and how they connect to communities and build communities is a more explicit goal." Having sessions over an extended period and spaced out throughout the year further helped teachers, as opposed to "just getting it all at one time"

(Tangela). Taylor's sharing reflected this sentiment the best, as she said: "doing it throughout the year while we're teaching ECS allows us to not necessarily like workshop lessons at the time, but like, bring in little things or little pieces of conversation." It connects back to making room for teachers' growth and reflection over time that Philip and colleagues [24] call for.

With foundational mutual respect and politicized trust, having several opportunities to contribute and to listen, particularly from diverse perspectives, was crucial for teachers' participation. Jennifer, a novice facilitator and ECS teacher, said, "I like talking with the other teachers and learning how their school works or where they live, their district; those differences are really interesting and really important." Further, Elaine shared how she "look[ed] forward to speaking with the rest of the group on the topic and hearing other people's perspectives." She would wait for a strong feeling before sharing her perspectives, "especially if I'm feeling like it's a little different, coming from a different place." John, a White male teacher similarly shared learning from listening to others during these sessions: "I in no way would have that understanding without because I can't be that other person. But, being afforded that opportunity to share with each other, I'm able to gain at least some understanding of other perspectives." Taghrid's responses echoed John's. She noted: "Your personal experience comes into [interpreting pre-work]. There will be a lot of sharing of personal stories, or that's happened to me or to my family. These things happen to people that I actually know and interact with. It's not just theory."

Teachers also noted how important it was to bring teachers and researchers from across the U.S. and abroad and diverse personal and teaching contexts to do this work. As Libbyada shared, "I think that all brought a bond with us and learned [from] each other from different parts of the world wherever we were, you know, in different states," highlighting the first author's affiliation with the Global South and other teachers spread across the nation. Elaine shared that this was an opportunity to meet teachers outside their school, especially when most computing teachers work as "singleton" in their schools. John highlighted how this meant learning about different teaching and political contexts about creating safe space within classrooms to do justice-oriented computing: "how different instructors in different regions that may or may not be specific to my context but may share similar or partial overlaps of the context, of ways they address, how to create a safe space."

However, a couple of teachers, less experienced within the ECS community, commented on how they felt that conversations strayed from the task at hand. While most teachers appreciated the openness of the breakout rooms to bring in personal stories (as discussed above), a couple of novice facilitators felt more strongly about sticking to the purpose of the breakout room, which was to brainstorm curricular connections. The tension was best captured in one of the teachers sharing: "Black people were harmed, maybe one or two days right before the [synchronous] session. And some people were really upset about that. And I totally understand the sentiment. It is just that I felt that the breakout room was not the purpose to vent your frustration." Yet another teacher, while acknowledging the need for these conversations, reflected on her initial perception as "conversations not focusing on the task at hand."

A few other teachers mentioned how they slowly understood the process and the expectations, since co-design sessions deviated significantly from teachers' prior professional experiences. As Tangela shared, they "never really thought that building a curriculum would entail all this," or how Taylor said she didn't think of "the process to be this way... I thought we were just going to jump in and be like, let's make this change, let's make this change." It is similar to Kristi's earlier sharing that teachers are expected to produce products/artifacts quickly. Don shared his initial lack of understanding of expectations around generating synthesis cards as a part of co-design pre-work. He preferred having guiding questions instead of the open structure. Similarly, Libbyada said she "didn't know what to expect coming in." Also, as one of the novice facilitators, she shared how she grew into the process, initially "seeing what others have to say, and then try[ing] to elaborate on it, but as the program went, [having] more to give towards the program." Or, as Lee and colleagues [19] discuss, John mentioned his struggles navigating multiple parts of the process spread across various digital platforms: "It was a little confusing at first, as far as what we're doing, we had the jam board, and then we had the slides. And then after a couple of sessions, once it was explicitly talked about, I knew exactly what to do." Teachers preferred having explicit instructions in terms of expectations to support them better to participate as co-designers.

6 DISCUSSION

Despite promising findings, we recognize limitations we plan to address in future iterations. First, we could not involve the co-design teachers in any part of the research due to time constraints and the ongoing nature of work (teachers are currently authoring lessons they envisioned). To align with the participatory design research and further strengthen the findings [28] moving forward, we plan to get back to co-design teachers, share the findings from the analysis, reflect with them, and include their perspectives further about designing co-design spaces for teachers. Second, we drew only from teachers' interviews for this analysis due to the space constraints of this submission. As we continue to engage with more data, we plan to triangulate findings reported in this paper with observational data from the co-design sessions and the teacher-generated products, which should further shed light on designing co-design spaces for teacher engagement as co-designers of justice-oriented programs, paying attention to the challenges teachers faced.

Teachers valued their involvement as co-designers and recognized it as a move away from deprofessionalization. They experienced tremendous professional growth as they engaged in the process. Further, teachers indicated the need to establish and sustain mutually respecting and trusting spaces with politicized trust to contribute as co-designers of justice-oriented computing programs. In their sharing, they emphasize the need to design for multiple opportunities to reflect, share, and listen as they work towards holding the safe space while co-designing. In their reflection, they highlight how teachers participating as co-designers would require more explicit directions on the expectations of the task and have time and space for teachers to grow into the process.

Teachers need to be involved as co-designers of curricular interventions. They value such engagement professionally and personally and support such design endeavors with their wisdom.

Professional spaces need to respect them and their perspectives. As discussed elsewhere, teachers contributed to expanding curricular lessons and activities to engage learners at intersections of social justice issues such as colonial logic and computing [13]. Not only can teachers' involvement support their learning, implementation of curricular interventions, and support agency, but it also elevates their profession and their voices and makes them central to design efforts that have consequences for their profession—as opposed to teachers being an afterthought in curricular initiatives.

While we invite teachers to co-design, creating a conducive environment for open engagement is important. Future policy and design efforts should budget for relationship building among teachers, for longstanding relationships make room to build trust among community members, especially while designing justice-oriented programs. Like teacher learning and professional growth [24], building relationships and fostering teacher communities that can serve as co-designers takes time. As seen in Tab. 2, the co-designer teachers in our project went as far back as a decade in facilitating teacher PDs. As teachers shared in their narratives, knowing some of the teachers in the room, and more importantly, having shared goals and values, helped teachers hold a space of mutual respect and politicized trust [31] that enables teachers to share, listen, and reflect while learning and being vulnerable. Future research and design efforts should create co-design spaces for teachers to make it easier for teachers to engage in addition to their existing teaching schedules [16]. It may mean setting expectations clearly at the beginning, supporting community development among teachers, and allowing opportunities intentionally to bring in their expertise.

In the face of political crisis and ongoing deprofessionalization of teachers across the U.S., resistance to justice-oriented programs is only on the rise. Opposition to teaching justice-integrated STEM has percolated computing classrooms where teachers face bans on what they can teach [26]. Solidarity with teachers [24] will mean both enabling them to be co-designers of curricular resources that are of consequence for their professional practice and, at the same time, leaning on their wisdom and experiences to understand how to implement justice-oriented programs in ways that are meaningful for marginalized students within computing classrooms. As research calls for integration of justice-related issues within computing to make the discipline relevant to lived experiences of marginalized learners [14, 17, 30], teachers as co-designers can partner within research and design efforts and further justice-oriented computing programs, not just by teaching a program handed to them, but by coauthoring such programs while shaping their professional and personal trajectories in meaningful ways.

ACKNOWLEDGMENTS

Many thanks to all the teacher facilitators who continue to serve as co-designers. This project is supported by National Science Foundation (NSF) under grants #2137975 to Joanna Goode and #2127309 to the Computing Research Association (CRA) for the CI Fellows 2021 Project. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not reflect the views of the NSF, the CRA, or the University of Oregon.

REFERENCES

- [1] Sareeta Amrute, Ranjit Singh, and Rigoberto Lara Guzmán. 2022. A Primer on AI in/from the Majority World: An Empirical Site and a Standpoint. *Available at SSRN 4199467* (2022).
- [2] Megan Bang and Shirin Vossoughi. 2016. Participatory design research and educational justice: Studying learning and relations within social change making. , 173–193 pages.
- [3] Ruha Benjamin. 2019. *Race after technology: Abolitionist tools for the new jim code*. Social forces.
- [4] Noelle Brown, Benjamin Xie, Ella Sarder, Casey Fiesler, and Eliane S Wiese. 2024. Teaching Ethics in Computing: A Systematic Literature Review of ACM Computer Science Education Publications. *ACM Transactions on Computing Education* 24, 1 (2024), 1–36.
- [5] Joy Buolamwini. 2023. Unmasking AI: my mission to protect what is human in a world of machines. (2023).
- [6] Kapur Center. 2021. Culturally responsive-sustaining computer science education: A framework.
- [7] Sasha Costanza-Chock. 2020. *Design justice: Community-led practices to build the worlds we need*. The MIT Press.
- [8] John W Creswell and Cheryl N Poth. 2016. *Qualitative inquiry and research design: Choosing among five approaches*. Sage publications.
- [9] Betsy DiSalvo, Jason Yip, Elizabeth Bonsignore, and DiSalvo Carl. 2017. Participatory design for learning. In *Participatory design for learning*. Routledge, 3–6.
- [10] Joanna Goode, Stephany Runninghawk Johnson, and Krystal Sundstrom. 2020. Disrupting colorblind teacher education in computer science. *Professional Development in Education* 46, 2 (2020), 354–367.
- [11] Joanna Goode, Jane Margolis, and Gail Chapman. 2014. Curriculum is not enough: The educational theory and research foundation of the exploring computer science professional development model. In *Proceedings of the 45th ACM technical symposium on Computer science education*. 493–498.
- [12] Margolis Jane, Estrella Rachel, Goode Joanna, Holme Jennifer, Jellison, and Nao Kim. 2017. Stuck in the Shallow End: Education, Race, and Computing.
- [13] Gayithri Jayathirtha, Gail Chapman, and Joanna Goode. 2023. "Social media is... sort of our East India Trading Company:" High School Computing Teachers Engaging at the Intersection of Colonialism and Computing. In *Proceedings of the ACM Conference on Global Computing Education Vol 1*. 84–90.
- [14] Yasmin B Kafai and Chris Proctor. 2022. A revaluation of computational thinking in K–12 education: Moving toward computational literacies. *Educational Researcher* 51, 2 (2022), 146–151.
- [15] Nick Kelly, Natalie Wright, Les Dawes, Jeremy Kerr, and Amanda Robertson. 2019. Co-design for curriculum planning: A model for professional development for high school teachers. *Australian Journal of Teacher Education (Online)* 44, 7 (2019), 84–107.
- [16] Jacob Kelter, Amanda Peel, Connor Bain, Gabriella Anton, Sugat Dabholkar, Michael S Horn, and Uri Wilensky. 2021. Constructionist co-design: A dual approach to curriculum and professional development. *British Journal of Educational Technology* 52, 3 (2021), 1043–1059.
- [17] Amy J Ko, Anne Beitlers, Brett Wortzman, Matt Davidson, Alannah Oleson, Mara Kirdani-Ryan, and Stefania Druga. 2021. Critically Conscious Computing: Methods for Secondary Education. *CONSULTATO: 10* (2021).
- [18] Clifford H Lee and Elisabeth Soep. 2016. None but ourselves can free our minds: Critical computational literacy as a pedagogy of resistance. *Equity & Excellence in Education* 49, 4 (2016), 480–492.
- [19] Victor R Lee, Jody Clarke-Midura, Jessica Shumway, and Mimi Recker. 2022. "Design for Co-Design" in a Computer Science Curriculum Research-Practice Partnership. In *Proceedings of the 16th International Conference of the Learning Sciences-ICLS 2022*, pp. 1049–1052. International Society of the Learning Sciences.
- [20] Phoebe Lin and Jessica Van Brummelen. 2021. Engaging teachers to co-design integrated AI curriculum for K-12 classrooms. In *Proceedings of the 2021 CHI conference on human factors in computing systems*. 1–12.
- [21] Tia C Madkins, Nicol R Howard, and Natalie Freed. 2020. Engaging equity pedagogies in computer science learning environments. *Journal of Computer Science Integration* 3, 2 (2020).
- [22] Camillia Matuk, Libby Gerard, Jonathan Lim-Breitbart, and Marcia Linn. 2016. Gathering requirements for teacher tools: Strategies for empowering teachers through co-design. *Journal of Science Teacher Education* 27, 1 (2016), 79–110.
- [23] Steven McGee, John Wachen, Lucia Dettori, Don Yanek, Faythe Brannon, Andrew M Rasmussen, Dale F Reed, and Ronald I Greenberg. 2019. Standardizing Facilitator Development for Exploring Computer Science Professional Development. In *2019 Research on Equity and Sustained Participation in Engineering, Computing, and Technology (RESPECT)*. IEEE, 1–3.
- [24] Thomas M Philip, Danny C Martinez, Eduardo Lopez, and Antero Garcia. 2016. Toward a teacher solidarity lens: Former teachers of color (re) envisioning educational research. *Race ethnicity and education* 19, 1 (2016), 182–199.
- [25] Thomas M Philip, Josephine H Pham, Mallika Scott, and Arturo Cortez. 2022. Intentionally addressing nested systems of power in schooling through teacher solidarity co-design. *Cognition and Instruction* 40, 1 (2022), 55–76.
- [26] Rafi Santo, Aman Yadav, and David Phelps. 2023. Their Fight is Our Fight: Why Computing Education Advocates Must Be in Solidarity with Public Schools. *ACM Transactions on Computing Education* (2023).
- [27] Samuel Severance, William R Penuel, Tamara Sumner, and Heather Leary. 2016. Organizing for teacher agency in curricular co-design. *Journal of the Learning Sciences* 25, 4 (2016), 531–564.
- [28] Mario Luis Small and Jessica McCrory Calarco. 2022. *Qualitative literacy: A guide to evaluating ethnographic and interview research*. Univ of California Press.
- [29] Sepehr Vakil. 2014. A critical pedagogy approach for engaging urban youth in mobile app development in an after-school program. *Equity & Excellence in Education* 47, 1 (2014), 31–45.
- [30] Sepehr Vakil. 2018. Ethics, identity, and political vision: Toward a justice-centered approach to equity in computer science education. *Harvard educational review* 88, 1 (2018), 26–52.
- [31] Sepehr Vakil and Maxine McKinney de Royston. 2019. Exploring politicized trust in a racially diverse computer science classroom. *Race Ethnicity and Education* 22, 4 (2019), 545–567.
- [32] Alicia Nicki Washington. 2020. When twice as good isn't enough: The case for cultural competence in computing. In *Proceedings of the 51st ACM technical symposium on computer science education*. 213–219.
- [33] S Wu, Amanda Peel, Connor Bain, Gabriella Anton, Michael Horn, and Uri Wilensky. 2020. Workshops and co-design can help teachers integrate computational thinking into their k-12 stem classes. In *Proceedings of International Conference on Computational Thinking Education 2020*.