

# Promoting socio-political identification with computer science: How high school youth restory their identities through electronic textile quilts

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**Abstract**—While many initiatives have broadened participation of minoritized youth in K-12 computing education, far fewer efforts have focused on expanding the social, political and cultural contexts of CS identity development. In this study, we propose a "restorying" pedagogy which engaged high school youth in interrogating dominant narratives about computer science through collaborative, electronic textile quilt-making. In our social design experiment approach, a workshop with 14 racially- and ethnically-diverse youth crafted and coded interactive quilt patches that were digitally "stitched" into a collaborative artifact, with each patch reimagining CS from youths' perspectives, particularly regarding what CS is, who can participate in CS, and how CS is done. By analyzing post-workshop interviews and participant artifacts, we observed that storytelling through quilting in computing education can act as accessible and authentic tools to support youth's political identity work, collaborative meaning making, and electronic counternarrative expression. In the discussion, we address how restorying can contribute towards developing critical computational literacies, political solidarity within CS learning environments, and self-authored identities among youth and educators.

**Keywords**— *Identity, electronic textiles, counternarratives*

## I. INTRODUCTION

*I really feel like the storytelling aspect really pulled it all together. Because when we were learning about it—my favorite part of this workshop was learning all of the history behind computer science—and being able to like, acknowledge the bad points of this history and this community, and then retelling it to what we hope for it to be or what it might be now, I really, really enjoyed that. (Tanya, post-interview, lines 99-103)*

There have been increasing efforts in the last decade to bring computing education into the K-12 education framework. Part of these efforts include broadening and deepening participation for minoritized students, both formally and informally.

However, most of these efforts have focused on students learning computational thinking content and practices. Vakil [1] reminds us that learning environments possess cultural and political values that promote particular ways of being, thinking, and doing that can impact the disciplinary identity work of youth, thereby promoting or limiting particular kinds of identities. The documented longstanding exclusion of women and Black, Latinx, and Indigenous students throughout computing education [2] requires a shift in attention toward understanding how computing learning environments shape disciplinary learning and identity work for minoritized learners. In order to better understand how minoritized youth negotiate their sense of self in relation to the dominant culture of computing and technology, we must provide learning opportunities where they not only learn computational thinking content and practices but can also reflect on and contextualize their computing experiences within the dominant and concealed narratives surrounding computing, computing education, and the historical exclusion of Black and Brown learners. Consequently, attempting to enculturate minoritized youth into computing while neglecting the ways in which computing education ignores their multiple social identities can further perpetuate the exclusion of racially and ethnically minoritized groups.

We draw on Thomas and Stornaiuolo's [3] conception of restorying—an analytic lens used in narrative and literacy research describing how youth use digital tools to reshape dominant narratives reflecting marginalized or silenced perspectives and experiences—as a potential learning tool for minoritized youth to use "new [computational] tools for naming oppression and narrating new visions for the future (p. 352)" [4]. Also referred to as a master narrative [5], we define dominant narratives as "an explanation or story that is told in service of the dominant social group's interests and ideologies" [6]. Considering that CS learning environments can reproduce dominant narratives and stereotypes that can negatively affect minoritized youths' sense of belonging in the field [7] [8],

restorying provides an opportunity for youth to contextualize their experiences with computing and technology in relation to the cultural and political ideologies regarding *what* CS is, *who* can participate in CS, and *how* CS is done. Furthermore, engaging youth in the restorying practices (i.e. self-making and worldmaking) builds on prior studies that engage youth in “challenging dominant and normative practices, give voice to marginalized perspectives, analyze sociopolitical factors, and initiate social change through the use of computational thinking practices (p. 484)” [9] through foregrounding developing youths’ imaginative practice, or the ability to dream up alternate futures [4].

In this paper we present findings from a 34-hour restorying workshop we developed and facilitated for racially- and ethnically-diverse 14-15-year-old participants in a STEM program at a local science museum, where youth designed interactive, electronic textile (hereafter, e-textiles) quilt patches that restoried dominant narratives about CS based on their lived experiences. E-textiles provided a compelling context for restorying because they juxtapose high and low technologies by integrating crafting and coding while also addressing historically gendered practices [10]. Building on the framework of identity as narrative through the stories we tell about ourselves, others, and our experiences [11], ultimately 14 youth designed electronic quilt patches while engaging in restorying, thereby combining e-textiles with the historical practice of quilting as a vehicle for youth to develop counternarratives about computing. To this end, we ask: *What does designing interactive, e-textile quilt patches that restory dominant CS narratives reveal about how high-school-aged youth identify with computing?*

## II. BACKGROUND

While computing identity has been a focus since early in CS education, a recent surge in publications has generated numerous new promising perspectives [12], particularly studies that leverage youth’s multiple social identities for transformative learning and positive CS identity development (e.g., [13] [14]). Identity work in justice-oriented computing education builds on sociocultural perspectives that understand learning and identity to be inextricably linked. As learners engage in the disciplinary knowledge and practices of a particular community, they undergo a transformation as they better understand themselves and their identities in relation to that discipline [15] [16]. Such perspectives invite understanding disciplinary learning at both an individual (through learner agency) and structural level (via institutions or culture), shifting our focus from examining identity solely at the individual level to exploring how learners author identities that can conform to, resist, or challenge the existing power structures within disciplinary learning environments [17]. As a way to empirically observe the identities youth author in the CS learning environment, we adopt a theoretical perspective of identities as both narratives [11] and “conceptual [artifacts] that contains, connects, and enables reflection over the emotional and cognitive processes of self-understanding and self-defining [across time] (p. 34)” [18]. By examining how CS learning activities can shape and are shaped by youth’s social and political identities [1], we as CS educators and researchers can better understand how to leverage their identities for

transformative learning that reimagines new worlds with regards to computing and technology. That is to say, through youth engaging in computational thinking skills and practices through the design of electronic artifacts that restory dominant narratives in CS based on their lived experiences, we can better visualize the CS identities youth author and the resources utilized through the counternarratives youth create.

To move computing identity work from theory to practice, we adapted restorying as a tool for participants to break down and synthesize CS stories in new ways in order to make meaning of their experiences. Restorying can also describe the ways in which young people use digital tools (i.e., online fan fiction, social media activism, and media production) “narrate the word and the world, analyze their lived experiences, and then synthesize and recontextualize a multiplicity of stories in order to form new narratives (p. 351)” [19]. As youth imagine themselves into dominant stories where they do not see themselves reflected, they engage in both self-making and worldmaking; youth reflect on their lived experiences within the context of broader historical systems of oppression, then reimagine alternate futures [4]. While restorying has been conceptualized as an analytical framework, we see potential in employing it as a learning activity for engaging youth in both computational thinking practices and historicizing their computing experiences within the dominant (and concealed) narratives surrounding computing. Restorying offers a model for designing computing learning environments that allow youth to consider their social and political identities as they consciously author CS identities challenging the dominant narrative surrounding computing and technology.

In our particular case, we used *quilting as a medium for restorying and identity work drawing on historical precedents in computing and communities*. The foundation of our approach drew on often forgotten historical connections between quilting and computing considering Jacquard’s 1803 loom considered a predecessor for modern computing [20]. As a practice, quilting has been used as a vehicle for women—particularly marginalized women—to express their social relationships, societal critiques, and histories. Black women, in particular, have utilized quilting as both an art form and sociopolitical tool for resisting oppression and reconstructing their experiences through creating records of their cultural and political pasts [21]; through the sharing stories and the forming of strong sisterhoods while quilting, “quilting [has] allowed [Black women] to express themselves in an artistic manner when few means existed for them to have a voice (p. 593)” [22]. As we can see, quilting has served as a vehicle for minoritized communities to develop and express counternarratives based on their lived experiences. Despite few studies and artistic pieces integrating computational components into quilting (e.g., [23]), there has yet to be a K-12 computing activity that explicitly leverages quilting’s potential as a tool for youth’s personal expression, collaborative meaning making, and counternarrative creation.

Inspired by Pinkard, Erete, Martin, and McKinney de Royston’s study of blending narratives with e-textiles [24], we used social design experiment approach [25] to design a pilot study with the purpose of youth create counternarrative-based quilt patches about computing through restorying dominant CS narratives. By drawing from their personal experiences with

computing and identifying dominant narratives about the discipline, minoritized youth designed paper-circuit-based quilt blocks that restored their connections to computing while developing computational skills and engaging in critical literacy practices [26], thereby illustrating their use of computing to identify with the discipline in novel, more meaningful ways. The ubiquitous and affordable materials provided a preliminary exploration for how e-textiles and its ties to crafting could be used as a medium for quilting. Through a combination of crafting, circuitry, and coding, e-textiles provide an ideal medium to integrate quilting with computing, and learners connect sewable Arduino-based microcontrollers with conductive thread to actuators such as LEDs and sensors, to make interactive craft projects [27]. Early research has demonstrated that e-textiles can be used to design culturally-relevant learning environments for youth—particularly minoritized youth (e.g., [28] [29])—to develop positive STEM and computing identities. By engaging youth in designing e-textile quilt patches that restore dominant CS narratives, we may better examine their computing identity work as they design electronic artifacts revealing not only their reflections about their imagined futures in relation to the political and ethical dominant narratives surrounding computing, but also revealing entirely new possible ways of doing, thinking, and being in the discipline.

### III. RESEARCH DESIGN

#### A. Methodology

Building on a pilot study implemented in 2019 [26], the 2020 study employed a social design experiment approach [25] to better understand minoritized youth’s computing identity work. While traditional design-based research tends to work inside existing institutions with the goal of developing new teaching and learning knowledge, social design experiments aim to transform social institutions by employing principles of equity and historicity in order for minoritized groups to become designers of their own futures. With each design iteration, theories of learning are challenged and refined as new theories emerge from the study that reflect youth’s development as conscious, historical actors who understand “how particular cultural practices came into being and how they have enabled and constrained possibilities for learning” (for example, how Black and Brown groups become minoritized in computing), and “how these understandings inform future-oriented practices (p. 567)” [25]. By minoritized youth developing the historical and critical analysis skills necessary for understanding the reasons and methods behind why and how their communities have been marginalized by the dominant narratives surrounding CS, they develop tools for engaging in and imagining more equitable futures surrounding computing.

#### B. Participants

The workshop took place with nineteen 14-15-year-old youth in a racially and ethnically diverse, STEM program at a local science museum. Demographically, participants in the program consisted of 9 boys and 10 girls, and the racial/ethnic breakdown of youth includes the following: Black or African American (8 youth), Asian (5 youth), White or Caucasian (2 youth), Hispanic or Latinx (2 youth), and Other (2 youth)

(anonymous demographic data was collected from the program manager and reflects descriptions used by the program). Given that youth apply to the program from different schools across the city, we assumed that they may have had a diverse range of knowledge and/or experiences related to STEM and computing learning. Therefore, understanding how youths’ multiple social identities impact their computing participation can illuminate their computing identity work while they design their quilts. Because we neglected to collect demographic information from participants directly and had to rely on anonymous demographic data, we did not feel comfortable identifying the gender or racial/ethnic breakdown of the 16 consenting/assenting participants of this study.

#### C. Workshop activities

Noticing how youth seemed to be negotiating the political dimensions of computing in the pilot study while designing paper-circuit-based quilt patches addressing issues surrounding race, gender, and access to learning CS, we redesigned the workshop to be implemented in two parts. During part 1, participants met weekly for two hours (10 hours total) and were introduced to computational thinking practices and activities (e.g., paper circuits, e-textile wristbands, and block-based programming) as well as the concepts of CS, computer scientists, and dominant narratives. Due to the COVID-19 pandemic, the workshop transitioned to virtual learning using Google Meet (which encrypts all its data during video meetings) for synchronous sessions and the digital portfolio platform Seesaw for youth reflection activities and design process documentation.

Part 2 continued remotely for three hours daily during the summer program (24 hours total) with a focus on “restorying” the dominant narrative of CS through designing and making interactive quilts. The mini-lessons cover topics including the dominant and hidden history of computing, systemics issues using computing (e.g., algorithmic bias), and the use of quilting and technology for activism. The workshop was updated to incorporate crafting and quilting practices in order for youth to design fabric-based, e-textiles quilt patches using Micro:bit microcontrollers, LEDs, touch sensors, conductive thread, and felt in order to explore the material and imaginative affordances for reflecting on, critiquing and reimagining dominant narratives about CS. After youth completed their individual quilt patch designs, thumbnails of their patch designs were digitally “stitched” into a collective quilt using a shared Google Document (see Figure 1), providing a collaborative artifact from which to discuss the collective counternarratives developed.

#### D. Positionality of authors

The first author codesigned the workshop with the fourth author and colleagues for the pilot study, co-facilitated the pilot workshop, and facilitated the workshop for this study. As a Black woman and former middle school science and STEAM maker educator, she has devoted the last seven years to designing transformative learning environments for minoritized youth. The second author participated in analyzing the interview and worksheet data and co-developing the codebook with other



Fig. 1. Collective digital quilt including participants' quilt patches.

authors. As an Asian woman, STEAM educator, and digital media artist, she has a passion for helping minoritized youth build their sense of agency and belonging by designing new media artifacts. The third author supported organizing, coding and analyzing the student data collected from the workshop. As an Asian woman, multimedia artist, and aspiring learning designer, she aims to further her research in community-based art initiatives for underrepresented youth in the arts. The fourth author is a Middle Eastern, European woman, learning scientist and faculty member dedicated to K-12 computer science education who has participated in the design and research of programming tools and activities.

#### E. Data collection and analysis

Data Since not all participants were able to remain until the end of the workshop because of the transition online, analysis focused on the remaining 14 consenting/assenting youth. Data collected included participants' artifacts [e.g., photos and videos of youths' quilts in interaction, the collective digital quilt including youth's quilt patches, activity worksheets, and Seesaw design journals], researcher memos, and post-interviews from participants. We should note that while analysis focused on completed quilt patches from 14 participants, one of those participants was unable to conduct a post-interview due to scheduling issues; however, she provided enough information about her quilt patch in her Seesaw journal that we felt warranted its inclusion in the analysis.

The first three authors conducted three rounds of comparative, inductive analysis of interview and worksheet data in order to develop a codebook and framework for understanding how participants' CS identity work. For our preliminary coding scheme, the first author conducted open coding of one of the interview transcripts and applied this coding scheme to two other transcripts, discussing and amending the codes with the second and third authors as necessary until a

consensus was reached. For the second round of analysis, we conducted open coding through content analysis of all participants' quilt patches and the collective digital quilt, identifying (1) each of the dominant narratives addressed, (2) how they were restoried, (3) the symbols used across designs, and (4) how interactions were programmed and incorporated into the quilt design. Post-interview and quilt data were triangulated against youth's Seesaw data (i.e., videos of quilts, activity worksheets, and design journal reflections). After analysis memos were written among the first three authors, we amended the coding scheme to better preserve participants' interpretations of their experiences and conducted a third round of analysis across the data, discussing and further defining the codes until consensus was reached.

## IV. FINDINGS

At the end of the workshop, 14 participants designed and created interactive, e-textiles quilt patches that restoried dominant narratives about CS across various social and political identity dimensions. We found that through engaging in restorying practices as well as computational thinking content, skills, and tools, (1) youth's critical reflection on the history of CS provide space for developing their political identities; (2) restorying through e-textiles served as a vehicle for youth to create and express counternarratives about CS; and (3) quilting can be seen as an embodied metaphor for collective meaning making, belonging, and the mixing of seemingly different technologies.

### A. Finding 1: Critical reflection on computing histories

Restorying dominant CS narratives provided youth the opportunity to develop their political identities and the agency to dismantle narratives based on power and privilege within CS. Out of the 14 finished quilt patches, 10 projects addressed issues related to power, privilege, and ethics in CS, whether themes tackled dominant narratives related to algorithmic bias, exclusion, sexism, racism, homophobia or ableism. For example, dominant narratives restoried across the quilt patches included: (1) only white people, particularly men, contributing to the CS discipline (Matthew, Nora, Amanda, Michelle, and Yesica); (2) girls not being able to do CS (Britney and Tanya); (3) people's overreliance on technology (which can still make racist mistakes, as Jordan reminds us); and (4) discrimination based on race, gender, sexual orientation, or ability (Layla and Ahmad). However, during post-interviews, most participants (10 total) expressed difficulty with understanding dominant narratives in CS at the start of the workshop, whether it was being unaware (Matthew, Yesica, Britney, Tina, and Amanda) or confused (Amanda) about what dominant narratives surround CS, people not actively thinking about them (Alexander), or not being sure how to address them (Layla). "It's like what people believe than what it actually is," Nora ascertained, reflecting how dominant narratives shape how people perceive reality [6]. Even though youth identify various challenges with the process, restorying dominant CS narratives supported the majority of youth (12 participants) in shifting their perceptions about discipline, from learning CS's history of exclusion to expanding who they believe can do CS.

Youth engaging in restorying practices also allowed them to reflect on dominant narratives in computer science in relation to

their present and future selves. Despite believing in dominant narratives and stereotypes about CS prior to the workshop—that CS is complex or difficult, boring, or only for white men—all participants who were interviewed after the workshop expressed desire and interest in participating in CS activities in the future. That being said, when students were asked whether or not they identified as computer scientists, 7 youth agreed while others shared varying perceptions on who gets to be a part of the CS community. While Matthew and Nora believed that anyone—whether they use a phone or TV (Matthew) or continue learning about coding and computers—could be computer scientists, others identified conditions they felt were needed before they could consider themselves computer scientists, such as needing more experience (Ahmad, Anthony, Tanya, and Alexander), not feeling confident with technology (Jordan), or feeling like they consume technology more so than create it (Tina). Further, Layla and Britney both noted how learning about CS through the workshop—which included not only learning CS content and practices but the dominant narratives surrounding who gets to be a part of CS—allowed them to *be* computer scientists, but on a smaller level with peers. Even though youth possessed varying degrees of identification with being computer scientists, the majority of youth (7 participants) expressed developing more understanding of CS as a discipline, while others (5 participants) believed after the workshop that anyone could do CS.

Across these examples, youth's identification as computer scientists reflects a process of their remaking what it means to be a member of the CS discipline and community through a historical, dialogical process, illustrating ways in which youth act as historical actors designing their own futures [30] [25]. Tanya explained this process as, "My favorite part of this workshop was learning all of the history behind computer science—and being able to like, acknowledge the bad points of this history and this community, and then retelling it to what we hope for it to be or what it might be now (post-interview, lines 100-103)."

As a student who self-identified as "one-fourth of a computer scientist," Tanya used her quilt (see Figure 2) to emphasize that women are not only capable of adding to the field of CS, but have added and will continue to add to the discipline. Based on her evaluation of CS history and its community, she drew upon her political identity to confront the "bad points" by highlighting women computer scientists in her quilt. She added that being able to create a visual narrative reimagining how women are portrayed in CS with e-textiles and programming made her feel proud. In this process, such dominant narratives and the silencing of alternative narratives in our society are visible for students to hold, confront, evaluate and transform [1], thereby transforming who they are and want to become in relation to the discipline. Through this critical and creative interpretation of CS and connecting those interpretations to their identity, youth participated in self-making practices [4] by creating counternarratives of who they are and who they might become, illustrating youth's interpretation of the values of CS discipline while evaluating their current and future selves in relation to CS through this workshop.

### *B. Finding 2: Exploring computing narratives by making interactive e-textiles*

Engaging in computing through e-textiles and restorying practices through quilting served as an innovative medium for youth to communicate and support their counternarratives about CS. Despite preconceived notions of quilting being an "old ladies' activity (Layla)," youth noted how designing quilt patches using the e-textiles materials (e.g., conductive thread, fabric, and LEDs) inspired new visions and uses for CS. When showing off her quilt patch to her mother, Britney commented on how her mother exclaimed, "Wow I didn't even know that like, [you] were doing computer science every day." Given that quilts are used "to get things across from people to people (Yesica)," integrating CS technologies into quilt patches using e-textiles can add additional meaning to their restoried narratives (e.g., Jordan reminded us how LEDs could be used to attract people to the quilt patches). Youth adapting and creating agency over this new medium required a combination of learning restorying practices as well as crafting, circuitry, and programming interactions for their restories, illustrating the potential of CS to be used for storytelling and counternarratives, as both Ahmad and Alexander noted.

In addition, youth demonstrated a mixture of feelings while mastering the tools to navigate and visualize their designs. At the start and during the process, nine youth shared frustration and nervousness during the design process, followed by satisfaction and accomplishment upon successfully overcoming challenges. "It was both fun and a challenge," Anthony recalled. "It was fun because, like, I could turn a story in my head and then make it something visual. But it was a challenge because of the same reason. I had to take that idea, which I could usually just say it and then, like, sew it onto a quilt (post-interview, lines 102-105)." In terms of interaction, Anthony programmed his quilt patch (see Figure 2) so that when button A is pressed, the LEDs associated with the stereotypical objects for CS light up and when button B is pressed, the LEDs associated with objects related to the interdisciplinary aspects of CS light up. However, when both buttons are pressed together, all LEDs light up and the Micro:bit presents the secret message "Computer science equals to computer science," implying that not one aspect of CS illustrated by the objects shown in the quilt is "more CS-ish" over the others. As we can see, Anthony used his quilt to dismantle the dominant narrative that CS is only programming by illustrating that CS can be implemented and transformed into other areas, such as engineering, robotics, and games. He expressed how the e-textile quilt patch enabled him to bring his story into life, through which he could "convey a message, without speaking." Through designing interactive, narrative-based e-textiles quilt patches, youth like Anthony could explore abstract ideas or concepts in a multi-sensory, concrete way, promoting an alternative lens for youth to imagine new worlds [19].

That being said, we should note that Tina was one of the only participants who expressed that CS is not something she would like to do in the future, despite finding the project fun (especially since she was able to bring her previous sewing skills to the activity). However, her expression of a lack of certainty regarding how it felt to reimagine the dominant narratives of CS and feeling as though she "uses" or consumes CS as opposed to

makes things with it (despite having just created a quilt patch) highlights the differences in how youth perceive the agency to imagine new CS futures.

### C. Finding 3: Quilting as an embodied metaphor

Designing Designing electronic quilts while engaging in the practice of restorying not only provided youth a novel approach for personal expression, but it also constructed a space for collective meaning-making as represented through the digital collective quilt. In other words, the practice of quilting served as an embodied metaphor that also supported youths' collective knowledge building and space making. Through participating in the discussions, engaging in the making process, and sharing their personal stories and restories with one another, youth transformed the CS learning environment into a meaningful, collaborative space where everyone embraced in restorying their own stories and imagining alternative ways of being, thinking, and doing in computing. Amanda, for example, described in her post-interview that she "[liked] the different, um, the group projects, we got to share our opinions. I liked that." This reflects how out of the various learning resources youth utilized when designing their quilts, almost half of participants (6 total) acknowledged their peer's stories and perspectives as helpful resources for restorying dominant CS narratives. All of these restories contribute to the practice of collective meaning-making, representing a large scale version of quilting bees [22]. Furthermore, by creating e-textile quilt patches, youth experienced a creative way to combine diverse technologies for personal expression. This process of mixing "soft" crafting techniques with "hard" computational techniques has also been regarded as a metaphor for quilting. In her post-interview, Britney communicated this perspective with the interviewer.

Britney: "Like, we're using a bunch of technology...at least for me, I had to like, look up ways to do different things with my quilt." (lines 104-105)

Author 1: "Ok. Oh, so you're kind of saying like using all the different technologies together is kind of like quilting." (lines 106-107)

Britney: "Yeah." (line 108)

Additionally, the collective digital quilt provided youth a third space [31] [32] to "stitch" different stories into a collaborative cultural artifact. It embraced them to bring their diverse life experiences, social perspectives, and personal values related to computing and marginalization in interrogating the dominant narratives about CS. By collective participation in the restorying process, youth reconsidered their social and political identities "outside the private self" [33] [1], and made sense of themselves from a social justice perspective. Furthermore, being part of the space-making process, four youth expressed a strong sense of belonging towards CS. They believed the historical narratives of CS could be changed progressively, despite acknowledging the negative points throughout the discipline's history. Yesica showed hope for how things can be improved in CS (see Figure 2) by stating that, "I felt like it's a good way to like, um, show things that could improve, and, you know, they might not really improve as much, but it's still a way

to show hope, and to continue pushing and fighting for the computer science that we want, in a way (post-interview, lines 106-109)." This hope empowered these youth to be a part of a community to change the dominant narratives and stereotypes of CS. Quilting from this perspective can be regarded as a social practice that collectively constructs a new image of oneself, the communities youth desire to participate in, and the world.

## V. DISCUSSION

After The findings from this workshop study provide promising insights of how we can engage youth in critical CS identity work. Most importantly, youth not only engaged in critical examinations but also learned about crafting and coding



electronic textiles. Making the e-textile artifacts also promoted connections of school and home. Our analysis also revealed the need for introducing and interrogating dominant narratives and the significance for supporting solidarity, to be discussed in more detail below.

### A. The need for support in revealing and interrogating dominant narratives

While restorying provided youth the opportunity to reflect on the dominant ideas, stories, and histories surrounding computing in their e-textiles quilts, we also noticed that the majority of participants initially expressed confusion regarding understanding the concept of dominant narratives, despite being able to readily recognize them once identified during discussions. One possible explanation is that the normalization of dominant narratives in society through repetition, authority, and the silencing of alternative narratives, this observation supports the idea how dominant narratives can appear objective and apolitical through functioning like an invisible current guiding our perceptions of reality [6]. However, we must remember that ideologies promoting the dominant culture of White supremacist capitalist heteropatriarchy [34] manifest themselves within the history of the computing discipline, whether it is through the exclusion of minoritized groups in computing education [2], the rise in discriminatory design using

computing (e.g., [35] [36] [37]), or silencing of alternative stories, like computer scientist Timnit Gebru's firing from Google for speaking out about diversity issues at the company [38]. If we want to support youth in imagining alternate presents and futures beyond oppression, we as designers of CS learning environments need to scaffold the methods for breaking down and interrogating the dominant narratives regarding the discipline of computing. Such practice involves not only developing awareness of the narratives in the first place but—and probably more importantly—it is imperative that youth develop an understanding behind how these narratives function rhetorically and systemically.

### B. *The significance for promoting and supporting solidarity*

A surprising but significant element of the study was the collective meaning-making and counter storytelling embodied through the digital quilt, which reflected a reimagined CS based on belonging, creativity, and a condemnation of oppression. Considering that participants were members of a STEM program that appears to reflect social justice aims through "[changing] the DNA of STEM education" and targeting underserved youth, this might provide an explanation for some of the shared political values across a diverse group of youth. That being said, we found it interesting how some youth seemed to use "we" when suggesting the possibility for change in CS or when envisioning what they hoped CS to be in the future after dismantling the dominant narratives. These differences in expression of political engagement with CS harkens to the concept of politicized trust, a form of trust that "acknowledges the racialized tensions and power dynamics inherent in design partnerships" (p. 199) through mutual political understanding, respect, and solidarity [39] [40]. Given the diversity in social and political identities related to computing in the workshop, we recognize a missed opportunity in not specifically addressing issues of power and privilege when restorying dominant narratives. True solidarity requires both political understanding of histories of oppression, marginalization, and power, as well as respectful interactions and relationships. As we consider ways to develop politicized trust among youth within computing learning environments (who each come from communities with distinct histories of oppression and potentially distinct experiences related to computing), it is important we consider what elements are necessary for promoting and supporting a shared solidarity and commitment amongst youth as they address dominant narratives within the discipline.

## VI. CONCLUSION

The One of the next steps is to move restorying quilts in formal computing classrooms. For this we need to prepare computing educators for engaging their students in discussions about dominant narratives. Aside from the Exploring Computer Science program, there are few computing teacher development programs that not only address histories of oppression within the discipline but also prepare teachers for engaging their students in such discussions. Fortunately, we see the process of designing quilts that restory dominant narratives as a practice computing educators can engage in, for they can develop both their computational competence and identities as justice-oriented educators. Computing teachers themselves can act as gatekeepers through exclusive pedagogical practices and

classroom structures, so we must consider providing them opportunities to also reflect on and challenge dominant narratives that minoritize Black and Brown youth.

### ACKNOWLEDGMENT

This work was supported by a grant from the National Science Foundation to Yasmin Kafai and Michael Eisenberg (#1742140). Any opinions, findings, and conclusions or recommendations expressed in this paper are those of the authors and do not necessarily reflect the views of NSF or the University of Pennsylvania. Special thanks to the participants from the workshop, Danielle Maurino for her help with recruitment, Gayithri Jayathirtha and Luis Morales-Navarro for their help with data collection and to Ammarah Aftab and Renato Russo for their valuable help with data analysis.

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