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Through Liberatory Computing Education*

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Alleviating the Danger Of A Single Story Through Liberatory Computing Education

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ABSTRACT

Computing curricula tend to inadvertently perpetuate a damaging singular narrative about African American communities. Two data activism programs were implemented, with a qualitative analysis tracking desire-based research integration into final student projects. In the second program, projects shifted to collaboration with community organizers, increasing the inclusion of desire-based research. Integrating community researchers into the technical curriculum empowers students to infuse data science projects with personal narratives, breaking away from the conventional singular narrative. Liberatory computing enables students to express a nuanced understanding of their experiences. These projects equip students with advanced data activism skills for active contributions to policymaking processes.

CCS CONCEPTS

• **Applied computing** → *Interactive learning environments*.

KEYWORDS

liberatory computing, data activism, artificial intelligence education, Black radical imagination, desire-based research

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1 INTRODUCTION

On July 2009 Chimamanda Adichie delivered a speech titled, “The Danger of the Single Story”, to a TED audience [21]. As an acclaimed and famous African novelist, Chimamanda recounts her road to

success and mentors us all on how we risk a critical misunderstanding if we have only a single story about a person or country. Understanding one’s history and recognizing the strengths and accomplishments of one’s culture are pivotal components of liberatory education initiatives [16]. African Americans often find themselves conditioned to harbor self-doubt [3], primarily due to a lack of exposure to the noteworthy accomplishments of African Americans during their K-12 education. Instead, instances of African American history in textbooks often depict communities as damaged, perpetuating unjust historical imagery. Throughout their K-12 experience, African American students are presented with a narrow and disheartening view of African Americans, contributing to a sense of disillusionment about their identity.

While formal education is just one avenue of learning and development, it plays a crucial role in shaping the lives of young African American individuals. Recognizing the limitations of institutionalized education, African American educators have consistently created spaces outside of school that center, acknowledge, and support African American youth [15, 23]. Past research underscores the rarity of such out-of-school, all-Black educational opportunities and their liberating impact on individuals, challenging rigid perceptions of reality [1]. One such initiative is our data activism program.

The concept of “homeplace” emphasizes hope as a significant element of all-Black educational opportunities. Black educational fugitive spaces are characterized as “radical sites of possibility” [2, 4, 8]. Historically, all-Black after-school community-based programs have established safe spaces, known as homeplaces, where participants explore their history, heritage, and community as assets in their educational development. Essentially, these programs are renowned for teaching African American students how to conduct research that cultivates their communities’ wisdom, hope, complexity, and self-determination of lived experiences.

However, one area of education in which there is still a racial disparity is data science [2, 24]. The reason why this gap persists is that a vast amount of data science curricula either doesn’t acknowledge the experience of Black students, or incorporates a damage-centered approach [1, 17, 18, 22]. This leads to disparities [19]. Since out-of-school programs for African Americans have shown to have a positive impact on students, we created the data activism program. The data activism program takes the idea of “outer space” from all-Black education initiatives and applies it to

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data science curricula. This paper discusses how the program is an out-of-school program that teaches African American students how they can use data science to mitigate systemic oppression. The data activism program stands out for its empowerment of African American students through liberatory computing. Liberatory computing ensures students acquire a sound racial identity, critical consciousness, collective obligation, a liberation-centered academic identity, and activism skills to transform systems where racism persists [7, 14]. This curriculum specifically tailors data activism for African American high school students, aiming to empower them to use data science to address systemic racism.

In the teaching of data activism, a desire-based research framework is prioritized over a damage-centered approach. Desire-based research explores the painful aspects of social realities alongside the wisdom, hope, complexity, and self-determination of lived experiences [1]. This unique data activism program empowers students by integrating a desire-based research framework and liberation tools, fostering personal and community upliftment. In the second program, qualitative analysis revealed that collaborating with community organizers enhanced the students' capacity to integrate desire-centered research into their final projects.

2 THEORETICAL FRAMEWORK

2.1 Desire-Based Research

In the realm of teaching data activism, a prevailing approach involves the use of a damage-centered research paradigm [1]. This approach pathologizes oppression as the sole defining factor of a community, often focusing on documenting pain or loss within individuals, communities, or tribes. In contrast, a desire-based research framework transcends a narrow focus on the painful aspects of social realities [1]. It embraces a holistic perspective, acknowledging the wisdom, hope, complexity, and self-determination inherent in lived experiences. An illustrative example of desire-based research is evident in the real-life update to the Clark and Clark doll tests. The "Stereotypes vs. Humantypes" exhibit featured a short film titled "A Girl Like Me," created by Kiri Davis during her high school years in New York City. Davis's film, part of her graduation portfolio at the Urban Academy public high school, mirrors the findings of the Clark and Clark doll tests [1]. It reveals that young Black children consistently preferred White baby dolls over Black ones. However, Davis takes a unique approach by interweaving this footage with scenes of young women of color discussing their hair, bodies, mothers, and identities. This editing technique aims to capture the beauty of young Black women, emphasizing the complexity and wholeness of their selves rather than perpetuating a narrative of "damage"[1].

2.2 Black Radical Imagination and Radical Love

In the data activism program, students employed a diverse set of activism skills encompassing data science, art, and literature reviews to support their communities. However, for the focus of this paper, we will delve into two vital activism skills crucial for maintaining hope while conducting desire-centered research: cultivating a Black radical imagination and practicing Black radical love.

Kelley asserts that cultivating a Black radical imagination through art, such as music and poetry, can "build community, establish fellowship, play and laugh, and plant seeds for a different way of living, a different way of hearing"[5]. Kelley emphasizes not only the role of art in the Black radical imagination but also the importance of community and fellowship. As noted by Robin D.G. Kelley, "Progressive social movements do not simply produce statistics and narratives of oppression; rather, the best ones do what great poetry always does: transport us to another place, compel us to relive horrors, and, more importantly, enable us to imagine a new society" [5]. Kelley urges us not only to critique systems of oppression but also to tap into the power of our creative minds to envision a world of infinite possibilities, drawing examples from figures such as Marcus Garvey, poets, and hip-hop artists inspired by Christianity and dreams of outer space. The data activism curriculum aimed to encourage students to use their Black radical imagination and contemplate tangible steps towards envisioning a new society.

One way we fostered a Black radical imagination in the students was by incorporating art into the projects. Various art forms played a pivotal role in envisioning a new world for the liberation of Black children, echoing Kelley's emphasis on the transformative power of art. In instances where movements struggle, poets and artists, regardless of their medium, often imagine depicting dreams and futures that social movements can bring forth [5]. Kelley emphasizes how having a Black radical imagination contributes to a sense of peace and freedom, where creating spaces for Black children to critically analyze oppression and envision a future revolutionizing society is crucial [3, 8, 9]. Also, Kelley underscores the importance of a new future grounded in love. A crucial facet of Black radical love involves directing students to contemplate self-improvement and self-love as a prerequisite to extending that love to others [6]. Darnell L. Moore, in "Black Radical Love: A Practice," underscores the importance of self-reflexive analysis and unlearning as strategies to avoid inadvertently reinforcing the systems we resist.

2.3 Data Activism Curriculum

The inaugural data activism program empowered students with the skills to leverage data science in identifying, addressing, and championing the causes of individuals disproportionately affected by systemic inequality (Fig. 1). Throughout the program, students engaged in diverse intersectional data analysis activities focusing on critical social justice issues, including but not limited to artificial intelligence (AI) fairness, food insecurity, gun violence, affirmative action, and diversity in entrepreneurship [10–13]. The culmination of their efforts was reflected in the final project, where students undertook comprehensive background research on a systemic problem, selected a relevant dataset, and executed an intersectional data analysis. Importantly, the students independently conducted their final projects, without direct collaboration with community organizers.

This second data activism program distinguishes itself by allowing students to incorporate a desire-based research framework and liberation tools, empowering them to uplift themselves and their communities. The final data activism projects, done in collaboration with community organizers through critical participatory action research (CPAR), feature data visualizations, interactive maps,

Week	Lesson Topic	Week	Lesson Topic
1	1.Intro to Data Activism 1 hour 2.Intro to Intersectionality 1 hour 3. Intro to CPAR 30 minutes 4.Data in Google Sheets 3 hours	6	1.Developing Research Questions 1 hour and 30 minutes 2.Research Protocols 1 hour 3.Research About Community Organizations' Mission 30 minutes 4.Relationship Building with Community Organizers 30 minutes 5.Research Question 2 hours
2	1.Intro to Python 5 hours and 30 minutes		
3	1. Visualizing Data with Pandas 4 hours 2.Data Drawings 1 hour 3.Breaking Down Stereotypes of Researchers 30 minutes		
4	1.Intersectional Data Analysis of Food Insecurity, Environmental Injustice, and Housing Inaccessibility Part 1 5 hours and 30 minutes		
5	1.Intersectional Data Analysis Part 2 3 hours and 30 minutes 2.Research Methods Round Robin 2 hours		
		7-10	1.Find Open Data 3-9 hours 2. Intersectional Data Visualizations 20 hours 3. Background Research 15 hours 4. Create Surveys 1 hour and 30 minutes 5. Send Surveys 1 hour and 30 minutes 6. Analyze Survey Results 1 hour and 30 minutes 7. Data Drawings 45 minutes 8. ArcGIS StoryMap 45 minutes 9.Present Findings to Stakeholders 5 hours

Figure 1: Data Activism Program Lessons

background research, and art projects (block-printed t-shirts, tote bags, stickers, and zines) that raise awareness about chosen topics and highlight community assets. This CPAR framework is firmly grounded in the principle that those individuals most profoundly affected by systems of oppression should lead the research process, actively shaping the research questions, design, methodologies, analysis, and ultimately determining the most effective products and actions for driving meaningful change [20]. Furthermore, the program fostered meaningful partnerships with three community organizations: Habitat for Humanity Greater Boston, Food Link, and the Charles River Watershed Association. Community organizers express their intent to leverage students' research to strengthen advocacy efforts in crucial areas such as inaccessible housing, food insecurity, and environmental injustice. The active involvement of these organizations proved instrumental in supporting the students' projects and creating a real-world context for their data activism initiatives.

Beyond teaching students about data science skills, we aimed to ensure that students had time to imagine a new world. Sometimes their dreams were more aligned with our reality, and other times they were more aspirational. The most disheartening scenario is reaching a point where we are so subdued by current circumstances that we can no longer imagine a different way of existing. For many people, the challenge lies in creating the space to envision a better future. Students learned to value art as a form of future building and culture change, facilitating shifts in infrastructure. The right to exist outside of societal expectations is crucial. Students had the opportunity to embody a different way of existing without fear of penalty.

3 POSITIONALITY STATEMENT

The primary researcher identifies as an African American woman. Our commitment to justice and liberation extends to those who face systemic oppression as the ultimate goal. As computing education researchers with diverse backgrounds in computing and teaching,

we recognize that certain aspects of our identities and careers have been sources of both harm and healing. Throughout this research project, we navigated the complexities of holding both the healing and harmful aspects of our identities through introspection. All authors share an understanding that without teachers comprehending the socio-political context of African American students, they cannot be truly loved or acknowledged within a school setting. Furthermore, we advocate for the creation of a supportive space for students—a homeplace where they can explore the painful aspects of social realities alongside the wisdom, hope, complexity, and self-determination derived from lived experiences. One of the main reasons students applied their data activism skills to environmental injustice issues is our conviction that we cannot view computing education or schools as the sole catalyst for improving outcomes for historically minoritized students. To achieve this, we must consider various systemic barriers beyond the school environment.

4 DATA SOURCES AND METHODS

This research paper closely examines students' final data activism projects, exploring the prevalent themes in desire-based research. These encompass beneficial components within their community, diverse forms of oppression, and the variations of oppression they aspire to address and transform. The guiding research question for our investigation is: "How does genuine engagement with communities impact students' inclination to incorporate desire-driven research in their final projects?"

4.1 Data Sources

We will examine the integration of desire-based research in the initial program by analyzing the final projects of seven students (six African American students and one Asian American student), each of whom worked independently. The context of the second data activism program will assess three final projects. In this second program, 24 students (all African American) were organized into three groups, collaborating with distinct community organizations:

Themes	Definition and Examples from Student Projects
Cultural Resources	We characterize cultural resources as elements within a community that evoke Black joy, encompassing murals featuring historic Black figures, and events and that honor their ethnic heritage.
Climate Injustice	The theme of climate injustice encompasses elements of students' projects delving into the unequal impact of climate change on minoritized communities. These projects include data visualizations showcasing the disproportionate effects of inland flooding on these communities.
Educational Inequity	Educational inequity is seen in student projects when they discuss how responses from community surveys emphasize challenges in enrolling students in schools that effectively prepare them for college.
Wealth Inequality	Wealth inequality refers to the uneven distribution of assets within a population. One example is an image underscoring the contrast between the median net worth of White families in Boston (\$247,500) and that of Black families (\$8).
Infrastructure Inequality	Infrastructure inequality examines how infrastructure projects can perpetuate societal disparities. Students explored this by connecting historical practices, such as redlining to the development of public transportation systems.
Lack of Safety	This lack of safety theme encapsulates students' reactions to the surge of violence in their city, with references to the absence of gun control.
Health Inequity	Health inequity encompasses disparities in health outcomes and healthcare access, including a shortage of mental health resources.
Housing Injustice	Housing injustice is systemic practices resulting in unequal access to housing opportunities. One example is redlining, which contributes to various forms of housing injustice.
Physical Space	The physical space theme explores students' appreciation for the open space and natural surroundings in their city.
Food Resources	This food resources theme outlines how individuals utilize various services, such as the Supplemental Nutrition Assistance Program (SNAP), food pantries, or other food support programs to meet their dietary needs.
Food Injustice	Food injustice arises when there are heightened disparities in food insecurity among minoritized communities. Students utilized data visualizations to underscore the connection between redlining and food injustice.
Oppression Related To Stereotyping	This theme delves into how stereotypes can harm minoritized individuals. For instance, a student cited the stereotype associating Black women with the notion of "welfare queens".
Environmental Injustice	Minoritized groups in the United States bear a disproportionate burden of environmental challenges. Students highlighted discussions on the scarcity of green spaces and trees, contributing to the formation of heat zones.
Raising Awareness	The theme shows that students integrated various elements into their projects to draw attention to specific issues. This includes instances where they discussed community organizations focused on creating awareness about injustice.
All Injustice	This theme illustrates how a multitude of injustices collectively contribute to systemic oppression.

Figure 2: Code Book

Habitat for Humanity Greater Boston, Charles River Watershed Association, and Food Link. The students were divided into three groups of eight to collectively undertake the projects.

4.2 Analytic Approach

After undergoing multiple iterations of qualitative analysis to code various aspects of their final projects, two researchers identified components of the projects that fell into three distinct categories of desire-based research: beneficial components for their community, desired transformations through action, and different forms of oppression. Subsequently, the two researchers coded the aspects of the project representing different themes (cultural resources, housing injustice, food injustice, etc.) emerging from the aforementioned categories (Fig. 2).

Interrater reliability during the qualitative analysis process was measured using the Cohen's Kappa statistic. The Cohen's Kappa

for the first data activism program reached 81%, signifying a substantial level of consensus. Also, the Cohen's Kappa for the second data activism program reached 78%, signifying a substantial level of agreement. Subsequently, we conducted a comparison of the percentage distribution of desire-based research categories between the first and second data activism programs to ascertain any observed changes. In our analysis, we identified a theme for each aspect of the project. However, should there be an outlier, it may still be considered in the final calculation.

The themes corresponding to each category are located in the respective results sections (Part A, B, and C). Each project underwent thorough coding, examining every aspect including introduction, background research, data collection, and data analysis. Every sentence and image was attributed its own theme, with one theme selected for each aspect. For example, within the Habitat for Humanity project, a sentence discussing the effects of redlining, "Redlining leads to decreased investments, declining property taxes,

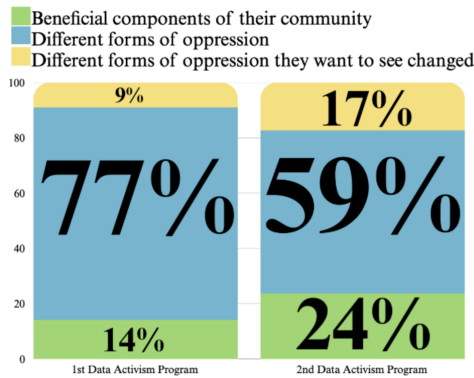


Figure 3: Comparison Of The Percentage Of Desire-Based Research Categories In The First and Second Data Activism Programs

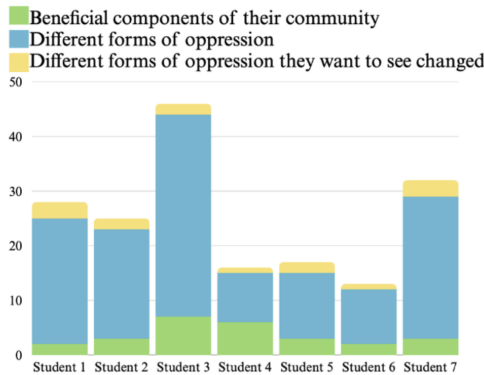


Figure 4: Percentage Of Desire-Based Research Categories In Each Data Activism Project From The First Program

and high levels of violence.” was categorized into multiple themes: “decreased investments” corresponded with “wealth inequality”, “declining property prices” with “housing injustice”, and “high levels of violence” with “lack of safety” as well. We documented the frequency of each theme for every individual project.

During the initial categorization of aspects within the final projects by the three desired based the category and subsequent theme, there were some outliers. However, through discussion, consensus was reached on appropriate themes. An example of such an outlier occurred in the Charles River Watershed Association project, where one researcher initially labeled a map connecting Dorchester’s location to an increased likelihood of flooding with the “environment” theme. Following discussion between the researchers, it was decided to reclassify the theme to “climate injustice” for that particular map.

5 RESULTS

We will compare the distribution of desire-based research categories between the first and second data activism programs to ascertain

any observed changes. In this section, we conduct a qualitative analysis of how students integrated desire-based research into their final projects, specifically illustrating the extent to which each group incorporated the beneficial components within their community, diverse forms of oppression, and the variations of oppression they aspire to address and transform. While all groups integrated some aspects of these aforementioned categories, there were variations in the degree to which desire-based research was incorporated. First, we compare the distribution of desire-based research categories between the first and second data activism programs to ascertain any observed changes. Then we will discuss the specific themes that emerged in each category.

Habitat for Humanity stood out for its exceptional ability to not only include data visualizations of community assets but also integrate different joyful images, events, and historical elements that define their neighborhood as a cherished home. In terms of the different forms of oppression that the students want to change, the Habitat for Humanity group went above and beyond by providing specific examples of parts of their neighborhood they dreamt of making safer. Conversely, groups such as the Charles River Watershed Association and the Food Link group placed a greater emphasis on exploring the different forms of oppression and the complexity of their lived experiences. They delved into the challenges and nuances faced by their communities, shedding light on the multifaceted aspects of their daily lives. In this analysis, we will emphasize how students and community organizers integrated emotional narratives and community knowledge into their final projects.

5.1 Comparison of First and Second Data Activism Program

The second data activism program incorporated more desire-based research components into their final projects (Fig. 3). Notably, the projects from the second program included 18% more information highlighting the beneficial aspects of their city, along with action items addressing various forms of oppression they aimed to transform. 41% of the final projects from the second data activism program featured insights into the positive components of their area and outlined actionable steps for addressing different forms of oppression. In contrast, only 23% of the final projects from the first program provided information on beneficial city components and actionable steps for change. The increased emphasis on beneficial elements and actionable strategies in the second data activism program may underscore the impact of collaborating with community organizers. This collaboration enhances students’ ability to focus on the positive aspects of their areas and encourages them to explore effective ways to bring about change in their communities. The integration of CPAR has the potential to cast their communities in a more positive light.

5.2 First Data Activism Program

Figure 4 outlines the percentage of desire-based research categories in each data activism project from the initial program.

5.2.1 Beneficial components of their community. 14% of the final projects in the initial program integrated valuable elements from their community (Fig. 3). Every student included some aspect of their city’s beneficial components in their final project. During

the final project phase, we prompted students to identify three community organizations, government officials, or nonprofits working to address the specific systemic oppression they researched. One student focused on analyzing Boston's energy and water usage by zip code and building type. They highlighted organizations and individuals actively combating climate injustice, such as "Our Climate", "Initiative for Energy Justice", Ayanna Pressley, Alexandria Ocasio-Cortez, and Elizabeth Warren.

5.2.2 Desired transformations through action. 9% of the final projects from the first program incorporated different forms of oppression they hope to see changed and the action items to do so. Every student included examples of different forms of oppression they hope to see changed based on action items through different data drawings. The purpose of these data drawings were to be clear action items in hopes of raising awareness about their systemic issue of choice. A drawing portrayed affordable housing as an umbrella, symbolizing protection for low-income Boston citizens. Though effective in some areas, the depicted holes in the umbrella highlighted regions with excessively high costs or a shortage of affordable housing options.

5.2.3 Different forms of oppression. The projects addressed various forms of oppression 77% of the time. Students were tasked with conducting an intersectional data analysis on a specific form of systemic oppression for their final projects. Our qualitative analysis delved into students' conceptualizations of systemic oppression affecting minoritized groups. Each project successfully explored how racism contributes to harm within African American communities. The final projects focused on housing injustice (two), climate injustice (two), educational inequity (one), lack of safety (one), health inequity (one), and food insecurity (one).

One student set out to dispel the myth of African American women as welfare queens in their final project. When discussing personal investment, the student revealed, "I chose this because I've faced demeaning stereotypes in popular culture about being a Black person on welfare. I used to feel ashamed picking up food from assistance programs at school. Pervasive stereotypes about Black mothers being welfare queens made their way into my life. However, there's nothing to be ashamed of but the system that failed many kids and families like mine. My data analysis aims to highlight how welfare has been cut off for many and how racial stereotypes perpetuate hatred towards Black and poor individuals."

Despite the majority of projects in the first program focusing on discussing different forms of oppression, it's remarkable that this student felt comfortable sharing this in a classroom setting. This became a heartfelt moment for everyone in the class when they shared it, highlighting how combining CPAR with data science can create a comfortable space for students. It is not very often that issues students go through are discussed in depth in computing classes, making these projects a homeplace for students to delve into personal moments and exchange stories, fostering a sense of connection and alleviating feelings of loneliness.

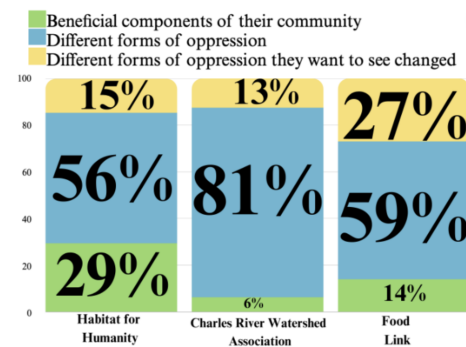


Figure 5: Percentage of Desire-Based Research Categories In Each Data Activism Project From The Second Program

5.3 Second Data Activism Program

5.3.1 Beneficial components of their community. Habitat for Humanity The students focused on addressing the racial homeownership gap and delved into its historical context, with a particular emphasis on the impact of redlining in Boston's Roxbury neighborhood. Students utilized data analysis to explore racial disparities and conducted surveys to gather insights from people. Firstly, we will discuss how the Habitat for Humanity group presented the beneficial aspects of their city. 29% of the Habitat for Humanity final project incorporated beneficial aspects of their community (Fig. 5). Within this category the theme that emerged was cultural resources (twenty-two).

Students identified several cultural resources as beneficial to their area, including murals depicting local civil rights leaders such as Martin Luther King and Malcolm X, images showcasing the vibrant Boston Carnival hosted by the Caribbean American Carnival Association of Boston, and various others. The group initiated their ArcGIS StoryMap with a compelling statement: "Roxbury, one of the oldest neighborhoods in Boston with a rich culture and significant African American history, including the historic Malcolm X's house, is a hidden gem. The area is known for its family-owned shops and lively summer carnival parade, making it an attractive place to live". This quote highlights how the curriculum empowered students to recognize the remarkable aspects of their city. Instead of solely emphasizing the negative aspects, they showcased the positive elements as a means to underscore their love for their neighborhood and the perspectives of its people. The fact that many students were from the neighborhoods they researched made it easier for them to appreciate the advantageous aspects of their neighborhoods. This experience emphasizes the need for more projects focusing on students' neighborhoods, as it prevents succumbing to the danger of a single narrative.

Also, the group collected photos and created 50 copies of the same zine to highlight the assets of their neighborhoods in Boston, including Roxbury, Dorchester, and Mattapan (Fig. 6). Within this zine, they included a quote from James Baldwin, a mural portraying Black joy, and family-owned shops that embrace their city. The zine comprised images showcasing the community assets in these

neighborhoods, challenging negative stereotypes and promoting a more positive image of their towns.

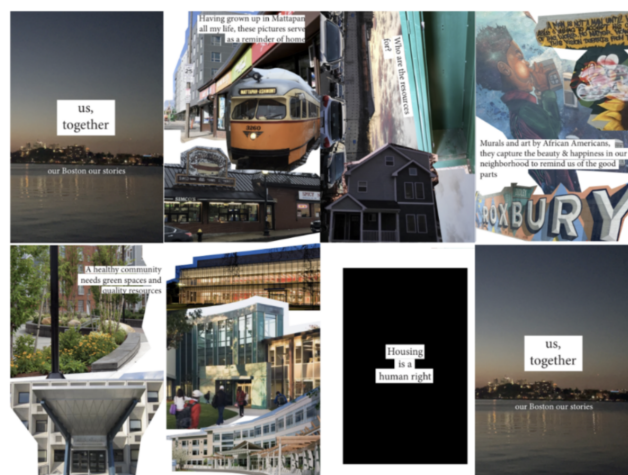


Figure 6: Zine with pictures of the areas in the neighborhood students enjoyed

Food Link This research team shed light on the severity of food insecurity by examining the demographics of the most affected areas and considering the historical context of redlining. To gain insight, the Food Link group directly consulted individuals utilizing food pantries, developing surveys distributed to over 50 different food pantries in the Greater Boston area. Survey analysis drew from data collected from 27 respondents, primarily regulars at the Cambridge Community Center Food Pantry, and the Salvation Army Food Pantry in Cambridge. 14% of the Food Link final project incorporated beneficial aspects of their community. Within this category, the theme that emerged was food resources (five).

While most survey participants expressed satisfaction with the support from their local food pantries, the students sought to understand the reasons behind choosing food pantries over grocery stores. Results indicated that grocery stores were as accessible to the city in terms of distance and transportation. The students extensively reached out to various entities, such as churches, food pantries, homeless shelters, and community centers. The comprehensive research showcased the existing support networks within their neighborhoods, emphasizing the district's collaborative efforts.

Charles River Watershed Association

Students conducted a comprehensive examination of the impact of flooding in Boston's Dorchester neighborhood, highlighting its disproportionate effects on low-income groups, particularly those with higher African American and Latine populations. 6% of their final project focused on the advantageous aspects of their community, all three of which were related to physical space (Fig. 5). The team showcased the beneficial components of their community through their final project, integrating data visualizations and an image.

By utilizing datasets from Boston's Open Data website, Analyze Boston, students collected information on the ratio of open space

to available space in Boston neighborhoods. Additionally, they conducted surveys to assess public awareness of flooding and its impact, reaching a diverse audience that included friends at schools, neighbors, school officials, and individuals across Boston. Survey analysis in the Greater Boston area garnered responses from 67 participants within a week and a half. Interestingly, the majority of survey responders expressed satisfaction with the amount of green spaces, trees, plants, or other forms of nature in their neighborhood. The students acknowledged the significance of their survey and efforts in raising awareness and educating the public about the risk of inland flooding. Their findings underscored the necessity for neighborhood involvement to effectively address these challenges.

5.3.2 Desired transformations through action. Habitat for Humanity The Habitat for Humanity group infused hope into their final project, aiming to address various forms of oppression and outline their vision for the future of their neighborhood. Approximately 15% of their project specifically focused on addressing different forms of oppression they aimed to change. Their project highlighted themes such as insights into general injustice (four), wealth inequality (two), and housing injustice (two). Additionally, there were singular cases of insights on educational inequity, health inequity, and climate injustice.

The majority of their aspirations fell under the overarching goal of eliminating all forms of injustice. A notable quote from their final project emphasized this broad vision, stating, "It's never too late, so the time starts now. Change isn't instant, so patience and time will be needed to vividly see the changes we envision for Roxbury. Let's foster more peaceful strolls down Marcella Park." This commitment to peace aligns with a Black radical imagination, signifying an essential element of a revolutionary world. The quoted passage reflects the students' profound love for their city, transcending the various forms of oppression they may encounter.

Another aspiration expressed by the students for their area's future is the desire to end wealth inequality. They state, "In the future, we aspire to conduct further research and enhance Roxbury's resources, income, and job opportunities." This dream underscores their dedication to continuous improvement and a collective effort to uplift the well-being and prospects of Roxbury.

Food Link The Food Link group conveyed their dream and vision of attaining a comprehensive understanding of the demographics and residential locations of individuals in relation to their access to food. Approximately 27% of the information presented in their final project centered around different forms of oppression they aspire to change. Within this category, a predominant theme emerged: their commitment to mitigating food injustice (nine). Additionally, there was one instance where they expressed the hope that Food Link would utilize their data visualizations to gain a better understanding of the communities they serve.

This research empowered both the students and Food Link to identify areas in Boston with elevated levels of food insecurity and estimate the financial resources required to effectively address these insecurities. Furthermore, Food Link plans to allocate surplus resources to food pantries in areas experiencing the highest food budget shortfalls, ensuring that targeted support reaches communities most affected by food insecurity. The final projects also aimed to encourage others to vote for policies addressing food insecurity.

Food Link's next steps involve formulating strategies to enhance food access for individuals in need, incorporating valuable insights from the students' research. These strategies include advocating for legislation that addresses systemic factors contributing to food insecurity.

Also, the students utilized block printing techniques to design over 40 tote bags and t-shirts. Each item featured graphics and phrases aimed at highlighting the urgent need to close the meal gap in Boston and raising awareness about mitigating food insecurity. The students' creative use of block printing visually conveys their message, encouraging others to join their cause. Overall, their efforts significantly contributed to raising awareness and promoting positive change in their neighborhood.

Charles River Watershed Association

The Charles River Watershed Association (CRWA) aimed to highlight the connection between redlining and communities disproportionately impacted by inland flooding in Greater Boston. Approximately 13% of the CRWA project contained information about various forms of oppression they wish to see changed. Within this category, they advocated for the end of all injustices (three), environmental injustices (two), and climate injustice (two). Additionally, there was one instance where they expressed the hope for an end to housing injustice.

In their final projects, students primarily discussed their desire to mitigate all injustices. They stated, "Our data analysis will be used to mitigate the damage that historical injustices caused in these communities." The students concluded that addressing inland flooding in Greater Boston is crucial and could be achieved by raising awareness in cities and local government through the creation of more green spaces.

To address environmental injustice, students urged people to visit the Charles River Watershed Association website to increase awareness, and they created stickers to spread the message. Through the creation of these stickers, the students realized that art doesn't have to be confined to a museum; it can be a part of everyday life. It was inspiring to see that the content on the stickers aligned with the mission of the association.

5.3.3 Different forms of oppression: Habitat for Humanity

Moreover, students demonstrated an understanding of the complexity of their lived experiences by conducting background research on various examples of systemic oppression in their neighborhoods. 56% of the Habitat for Humanity group's final project discussed different forms of oppression (Fig. 5). Within this category, the following themes emerged: housing injustice (eleven), lack of safety (seven), wealth inequality (six), educational inequity (five), climate injustice (three), and food injustice (two).

Utilizing data analysis, they explored racial gaps in South Boston and Roxbury, employing Python and Pandas, popular data analysis tools, for cleaning and analyzing the data. Overall, the students' data analysis enhanced their understanding of racial disparities in South Boston and Roxbury, laying the groundwork for developing support strategies for families with limited access to essential resources.

Food Link The students' data activism project illuminated the complexity of their lived experiences by integrating data visualizations and personal stories. Collaborating with Food Link, their project aimed to tackle food insecurity in the Greater Boston area.

59% of Food Link's project focused on different forms of oppression (Fig. 5). The themes that emerged were food injustice (twelve), housing injustice (seven), and wealth inequality (three). There was one mention of infrastructure injustice.

Students engaged in a comprehensive exploration of food injustice through a combination of images, data visualizations, interactive maps, and personal stories. In their presentation, they shared the poignant narrative of Zuri Dixon, a mother of four special needs teenagers who experiences food insecurity despite her husband's full-time employment. The students aimed to analyze the demographics of affected areas and understand the underlying reasons for the impact, whether rooted in historical, social, or political factors. Notably, some team members opened up about their personal experiences with the challenges of food insecurity, highlighting the deeply personal and significant nature of this topic for them.

Housing injustice was a recurring theme as the group delved into how redlining contributed to food insecurity in communities with a significant number of marginalized populations, such as Roxbury and Dorchester. Through meticulous data analysis and interactive maps, they unveiled that the ten Greater Boston towns with the highest rates of food insecurity and food budget shortfalls exhibited a notably higher Latine and African American population, along with a substantial low-income population. This project afforded the students a unique opportunity to witness firsthand the causes and impacts of food insecurity within the communities they call home.

Charles River Watershed Association The students incorporated the complexity of their lived experience when they used open data to analyze potential stormwater flooding in different areas of Boston. They used data from the National Oceanic and Atmospheric Administration to estimate how much rain is likely to fall during a storm and factored in the higher sea level to determine the areas most at risk of flooding. The students created maps showing the areas that will be affected by floods in the 2030s-2050s and the 2070s or later, as well as a map showing the community assets, such as churches, homeless shelters, and hospitals, that would be affected by a flood. Also, students created bar charts showing the number of people per hospital and fire department in each neighborhood, providing a visualization of the impact of potential flooding on people.

6 DISCUSSION

In the discussion section, we discuss how the program has had a significant impact on students across several key areas of liberatory computing:

1. **Sound Racial Identity:** A significant outcome of the data activism program was its ability to alter the prevailing research dynamics in support of African American high school students and community organizers, elevating their local knowledge and expertise. In regards to students being able to see race as an essential aspect of their identity, the fact that the Habitat for Humanity group incorporated many voices of famous African American authors and images of joyful African American children having fun and enjoying life, shows that some of the students increased their sound racial identity. These voices, often overlooked in the data science decision-making process, gained prominence through the program. Moreover, these initiatives went beyond merely providing

students with a voice; they established a space where some students felt comfortable enough to express their positive sentiments about their city.

2. **Critical Consciousness:** Although, we had aimed to inspire the CRWA and Food Link groups to integrate more enjoyable facets of their districts, the group shed light on the repercussions of inaction. For future data activism programs, emphasis will be placed on ensuring that students take the time to incorporate both their community's expertise and the collective aspirations for their area. This approach will contribute to a more comprehensive and nuanced understanding of desire-based research, fostering meaningful connections between data analysis and the lived realities of the communities involved.

3. **Collective Obligation:** Throughout the project, students grasped the significance of leveraging their individual strengths to enhance the overall quality of their final project. This underscored the message that, as African Americans, they should actively contribute to the positive change needed in the world, especially since they were part of groups exclusively comprised of African Americans making a difference.

4. **Liberation Centered Academic Identity:** The students not only confronted the challenges of their city but also shared moments of hope for themselves and their neighborhood through data activism. We were impressed by how some students eloquently expressed these feelings of hope, offering the reader a deeper understanding of who they are.

5. **Activism Skills:** Students learned how to transform into community experts and researchers, acquiring the ability to translate their daily experiences into impactful projects that others could benefit from and learn from their expertise. Leveraging their data science skills, the students adeptly illuminated various forms of oppression. Noteworthy examples of student activism included the creation of interactive maps and narratives that shed light on pertinent issues from their unique perspectives.

7 LIMITATIONS

One limitation is the oversight of students' intersectional identities, including gender and socioeconomic status. This oversight could decrease the generalizability of findings. Also, there is a need for additional activities that instruct students on showcasing the beneficial aspects of their neighborhood and their race, enabling their projects to reflect the aspects they take pride in from an African American perspective. Future research will explore the experiences of students with diverse intersectional backgrounds and identities to gain a deeper understanding of their interaction with the curriculum.

8 CONCLUSION & FUTURE WORK

In conclusion, the incorporation of CPAR and data science research opportunities increases the number of times that students incorporate the beneficial components of their community and desired transformations through action. Also, the curriculum inspires African American students to advocate for policies that hold personal significance. Looking ahead, our aspiration is to assess whether this curriculum has influenced students' career trajectories and if, in the long run, they choose professions aligned with

employing data activism to champion social justice policies. Also, we see the potential need for additional activities highlighting the positive aspects of students' communities, both leading up to and during the final project. While we aspire for students to affect societal change, we also prioritize their enjoyment. We advocate for incorporating activities that foster joy, playfulness, and laughter while maintaining a sense of purpose in supporting their communities. It's essential that students do not feel overwhelmed by undue pressure to change the world.

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