

Liberatory Computing Education for African American Students

Raechel Walker

*Massachusetts Institute of Technology
Media Lab
Cambridge, MA
raechelew@media.mit.edu*

Eman Sherif

*University of California, San Diego
Computer Science and Engineering
La Jolla, CA
esherif@ucsd.edu*

Cynthia Breazeal

*Massachusetts Institute of Technology
Media Lab
Cambridge, MA
cynthiab@media.mit.edu*

Abstract—The underrepresentation of minoritized groups, particularly African Americans, is the longstanding reality of computing fields. Computing has the opportunity to change the world and is increasingly being incorporated into our daily lives. Computing classes discuss computing as abstract, neutral, utopian, and unable to cause harm. While everyone needs to be part of the process of ending a multi-layered system of barriers, we focus specifically on why this goal is of particular relevance to African American students. We highlight Dr. El-Amin’s “liberation tools” which state how a sound racial identity, critical consciousness, liberation centered achievement identity, collective obligation, along with activism skills are essential to preparing African Americans to “fight for” racial liberation. Given that computing classes teach students critical thinking skills to solve complicated problems, we argue that computing is well-positioned to incorporate “liberation tools”. Liberation tools teach students how to think in terms of systems, which is essential for racial liberation. By expanding the liberation tools, we coin the term, “liberatory computing”, to reveal how computing curricula can motivate and provide African American students with practical skills to address the racism embedded in society.

Keywords—liberatory computing, activism, liberation tools, justice, broadening participation in computing, critical consciousness, computing education, antiracism, data activism, racial identity, collective obligation, liberation centered academic/achievement identity

I. INTRODUCTION

We can not expect a more diverse computing workforce while underrepresented students fail to feel a sense of belonging [11]. Less than 4% of computer science Bachelors degrees are awarded to Black or African American students [27]. These percentages for African Americans in computing fields has not increased [3]–[5], and there has been limited research on each subgroup [2], [6], [8], [9], [17].

One barrier to African American participation in computing is the presentation of computing as a neutral field with no connection to social justice [12], [16], [18]. Additionally, a vast amount of African American students are not taught how technology is utilized to surveil, police, and incarcerate

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their community [25], [33], [34]. In hopes of creating radical change, it is essential to understand the difference between navigating and transforming society. The liberation framework is defined as “an alternative contemporary emancipatory school model for African Americans that is attentive and responsive to the powerful role of racism in African Americans lives, and is intended to prepare African Americans not just to thrive in this society but also – as racial liberation truly requires – to re-envision society and create a fully humanizing alternative” [13].

We begin this position paper by introducing the five elements of the liberation framework. In this proposal, we introduce the term, “liberatory computing”. Liberatory computing is a framework that ensures African American students acquire a sound racial identity, critical consciousness, collective obligation, liberation centered academic/achievement identity, as well as the activism skills to use computing to transform a multi-layered system of barriers in which racism persists. Dr. El-Amin and I utilize the term “tool” to describe how the “five pillars should serve as the backbone of a contemporary emancipatory school model” [13]. There are many types of computing curricula, but we propose a data activism curriculum that incorporates liberatory computing for African American middle school and high school students. There is no literature that we are aware of that teaches how to incorporate every liberation tool into a computing curriculum.

II. BACKGROUND

This background section begins with an overview of the five pillars of the liberation framework: (1) sound racial identity, (2) critical consciousness, (3) liberation centered academic/achievement identity, (4) collective obligation, and (5) activism skills. We discuss how the liberation framework extends the literature about educational theories that focus on transforming society. Although there are curricula that individually incorporate some of these liberation tools [29]–[32], liberatory computing draws attention to the importance of incorporating all of these tools. El-Amin illustrates “how all of the pillars in this educational framework are intricately interwoven and none of them can work alone to ensure the desired result.” [13]. Educators can practically teach African

American students how to combat institutionalized oppression while centering the African American experience.

El-Amin created the liberation framework for African Americans because “the situation of African Americans has been qualitatively different from that of any other racial or ethnic minority in the United States.” [24]. Additionally, we take a similar stance to El-Amin when she states “the systematic and deeply entrenched nature of racism in the U.S. context has been abundantly covered and descriptively and empirically written about. As such, this work assumes that the reader knows that the United States as it currently stands both sits in and promotes racist ideology, beliefs and subsequently creates and sustains racist individuals.” [13].

In 1619, American slaves were forbidden by law to read and write with the penalty of death [36]. Even after slavery was outlawed, the “separate but equal” or Jim Crow laws created an inequitable educational system because schools were separate but never equal [35]. African Americans were forced to attend underperforming schools where they were more likely to be expelled and/or receive harsher punishments than Caucasian students [23]. Nevertheless, this curriculum can still be applied to other races because “to examine success among students who have been least successful is likely to reveal important pedagogical principles for achieving success for all students” [10]. As a result, we propose a curriculum that contends with the racist and violent history against African Americans by discussing how liberatory computing assists African Americans in deconstructing racism. It is impossible to use computing to transform society without these five pillars.

III. LIBERATORY COMPUTING THROUGH DATA ACTIVISM MODULES

As bell hooks states, “The classroom remains the most radical space of possibility in the academy... Urging all of us to open our minds and hearts so that we can know beyond the boundaries of what is acceptable, so that we can think and rethink, so that we can create new visions...” [20]. By incorporating an activist lens in computing curricula and pedagogy, the computing field will attract more African American students and pave paths toward social impact. While students should feel they can define their own form of activism, we propose an example of a liberatory computing curriculum that enables students to dismantle systemic racism.

In order to provide specific examples, we focus on one computing subfield, data activism. Data activism involves using data science to challenge power inequalities, such as racism [7]. Key data science skills include data analysis, modeling, collection, privacy, visualization, and policy. Our proposed data activism modules provide inspiration for teachers, policy makers, and other practitioners. It consists of five modules, one for each liberation tool. While this position paper focuses on data activism modules, liberatory computing should be the foundation of every computing class not just an elective. Through this data activism curriculum, students learn how to use technology to help their communities, as well as the limitations of technology in entirely eliminating racism.

A. Sound Racial Identity Activity

Dr. El-Amin states, “A sound racial identity ... assists African Americans in seeing that the stereotypes about their group are likely false” [13]. Currently, African Americans are not taught their true historical contributions in their formative years. A sound racial identity is emphasized in culturally relevant-sustaining computer science and culturally responsive computing because these frameworks are centered around increasing underrepresented students’ computing self-efficacy [30], [32]. Critical computational literacy highlights the importance of having a sound racial identity by embracing one’s intersectional identities [29]. Additionally, “integrating students’ cultural wealth” is central to developing a sound racial identity in high school computing programs [31]. It is essential that African American students understand how their racial identity shapes their experiences, self-perception, and how others perceive them [39]–[42]. Although a sound racial identity is the foundational pillar, it does not ensure one’s ability to take apart or analyze hidden systems of oppression [13].

Activity: Intersectional Data Visualizations In the Intersectional Data Visualizations activity, students conduct an intersectional analysis by recording data about their identity for a week. Next, they will create a drawing that represents their data. This activity is inspired by the book titled, “Dear Data”, where the authors accumulated data about their lives, then created a drawing representing their data [38]. Dr. Buolamwini introduces intersectional analysis in her research to reveal how gender classification algorithms recognized individuals with deep skin tones less frequently than those with fairer skin [21]. In this activity, students will communicate the story through their data set about a contemporary issue by finding patterns in the data. After, students draw a data visualization and legend using icons, shapes, lines or figures to humanize the data. A vast amount of people do not know that someone’s race can be associated with a greater chance of living in a food desert [46]. Research has shown that there is less access to affordable healthy food in predominantly African American neighborhoods. As a result, students may choose to analyze food disparity in their city by recording the difference between easy access to junk-food versus healthy and affordable food. For instance, students can create a drawing of the logos from fast food and healthy restaurants they notice in their neighborhood. This activity encourages students as data activists by providing them a new lens they can use to analyze computing artifacts and their own lives.

B. Critical Consciousness Activity

Critical consciousness is the ability to recognize, resist, and analyze systems of inequality. Students need to understand the roots of their oppression before they can change the source of their oppression. To control the narrative is to control the power. Critical consciousness is essential to effectively ending racism, but it is not enough because it is achieved through having a sound racial identity [13]. Culturally relevant pedagogy and critically conscious computing consider how

student knowledge in critical consciousness and computing will assist them in understanding and analyzing how computing may amplify the oppression of certain groups [28], [29], [31], [32], [47]. However, critical consciousness is not enough to transform society because it “doesn’t define that action explicitly as collective” and it could be used for “purely individual ends” [13].

Activity: Data Nutrition Label Students will use the concept of Data Nutrition Labels to create labels for existing data sets that contain undetected racial bias. The aim of this activity is to clearly and concisely describe the data set ingredients and to “encourage the collection of better and more complete data and more responsible usage of such data” [22]. A Data Nutrition Label for the US census data set could contain information about the possible harms of using this data set, such as privacy, racial bias, socioeconomic bias, and gender bias. Since the census has undercounted African Americans and Native Americans in the past [37], [44], [45], the Data Nutritional Label would contain a warning label about representation bias. As a result, African American students will become committed to taking action against systems of oppression because they know how to communicate information regarding bias.

C. Collective Obligation Activity

Since the beginning of slavery, fear of uprisings led to laws that punished and killed African Americans for gathering. Separation was subconsciously ingrained into African Americans by house slaves receiving “better” treatment than field slaves when they were both slaves [37]. As a result, many African Americans believe they have to compete against one another in order to accomplish their goals. “Racial group identity + belief that the group is deprived of power + rejection of rationale for this deprivation + belief that pooling resources will help eliminate obstacles” equals collective obligation [13]. According to El-Amin, African Americans must believe in linked fate, which is the concept that one person is not free until everyone is free [13]. It is essential that African Americans harness their collective voices to create social change. Teaching African American students to advocate for themselves and their communities in computing leads to more inclusive technology.

Although the literature about broadening participation in STEM does not mention collective obligation specifically, past research papers do mention community [2], [19]. Culturally relevant-sustaining computer science education incorporates the importance of including diverse groups of people in a class setting [28]. However, collective obligation requires understanding the source of their groups’ oppression while having a sense of responsibility for their community.

Activity: Paying It Forward In the Paying it Forward activity, students learn about collective obligation by teaching younger people about data activism. Students choose one topic from the data activism curriculum and design a learning activity for youth. We encourage students to include the child in the entire design process. Teachers should provide guidance on how to create an age appropriate curriculum. For

example, students can incorporate characters from the child’s favorite shows and video games. African American students will realize that they do not have to wait until they are older to have a meaningful societal impact.

D. Liberation Centered Academic/Achievement Identity Activity

El-Amin states, “Educators need to be as direct and relentless in providing African Americans with positive messages about their racial groups’ academic competence as society is in presenting negative messages” [13]. The Liberation Centered Academic/Achievement Identity (LCAI) ensures that African Americans realize they can use their academic success to address racism for themselves and their community. It is common for African Americans to experience discrimination in STEM classes regarding the stereotype that African Americans are not scientists [2], especially African American women [1]. As a result, one of the tenets of culturally responsive computing is that “the learning context supports transformational use of technology” [32]. Essentially, an increase in African Americans in computing does not necessarily benefit African Americans until they use their educational benefits to directly liberate other African Americans.

Activity: Evocative Audits The evocative audits activity builds upon having a LCAI as well as learning how to embrace their complex identities for social change. This activity requires students to use art (animation, embroidery, literature, drawing, graphic art, dance, fashion, etc.) to show how data science has transformed their communities’ socio-political realities positively and/or negatively. Buolamwini coined the term, “evocative audit”, which reveals how artists and activists must humanize the harm of algorithms to dismantle systems of oppression [26]. In order for students to fully embrace their academic abilities, they must remain comfortable with bringing their full selves into data activism. Buolamwini embraces her LCAI by being a computer scientist and a poet of code. In the Netflix documentary titled, “Coded Bias”, Buolamwini uses poetry and cinema to explain how discrimination is embedded in facial recognition algorithms. Another example of an evocative audit project is an infographic about the gentrification of historically African American neighborhoods [43]. The infographic could include two pies that compare the composition of a historically African American neighborhood 10 years ago vs today. Each pie could contain different sizes of slices that represent the percentage of land that is owned by companies, unaffordable housing complexes, housing predominantly for African Americans, etc. This infographic will show the many factors that force African Americans out of their historical communities.

E. Activism Skills Activity

In order to end systemic oppression, we must ensure that these activism skills are tailored specifically towards educating students about using computing as a “communication medium for activism,” and using “technology as part of the activism” [14]. Computing curricula should be taught

in a manner that leverages activism. Computational action, culturally relevant-sustaining computer science, critical computational literacy, and culturally responsive computing are examples of using technology to make an impact in people's lives [15], [29]–[32]. Activism skills are essential to creating social change because they can enhance one's competencies in all of the five pillars through "knowledge of the problem, efficacy to fix the problem and a deepened commitment to the cause" [13]. There are several skills that students need to learn in order to be data activists, such as quantifiable action skills.

Activity: Quantifiable Action Throughout this activity, students use data activism to address this prompt: "How might we empower our community to address potential disparities?" In order to answer this question, students complete an exploratory data analysis of a social justice topic. Students learn how to advocate for people that are disproportionately impacted by systemic inequality throughout the entire data science development process (data mining, data cleaning, exploratory data analysis, modeling, visualization, storytelling). One example of a Quantifiable Action activity is to analyze bias in a data set about the probability of an incarcerated person becoming a repeat offender. First, students will understand the historical bias of the criminal justice system. Next, students will use data science to analyze how a risk assessment software, named COMPAS, wrongly predicted that Black defendants were more likely than Caucasian defendants to re-offend. Then, students will host workshops and generate policy reports to teach their community about how AI exacerbates racism and how AI can empower their communities. This Quantifiable Action activity teaches students the critical thinking and programming skills required to challenge social injustice and how to tell a compelling story.

IV. DISCUSSION

Our data activism curriculum indicates that liberatory computing can be incorporated into traditional computing curricula. In Table 1, we present goals and objectives for a data activism curriculum. These specifications are intended to guide teachers through analyzing whether students are learning from the activity. Students must demonstrate competency in every pillar because all of the pillars are interconnected and build upon each other.

El-Amin asserts, "Three of the pillars simply cannot exist without a Sound Racial Identity: (1) Critical consciousness (about race), (2) Collective Obligation and (3) Liberation Centered Achievement Identity. Critical Consciousness may also serve as a basis for Collective Obligation and a Liberation Centered Achievement Identity. Further, Collective Obligation helps facilitate a Liberation Centered Academic Identity, while Activism Skill building has the potential to deepen and enrich each one of the pillars." [13]. In order to use computation for racial liberation, African American students must understand the historical context of why and how technology exacerbates racism in their communities. In hopes of protecting one's civil liberties, students must understand they possess the ability to address systemic racism.

TABLE I
DATA ACTIVISM CURRICULUM GOALS AND OBJECTIVES

Liberation Tools	Data Activism Curriculum Goals and Objectives
Sound Racial Identity: Students acknowledge how their racial identity shapes their experiences, self-perception, and how others perceive them.	Intersectional Data Visualization: Through visualizing data to describe their lived experience, students believe that race is an important part of their identity.
Critical Consciousness: Students understand the roots of their oppression so they feel a sense of urgency, which leads to action.	Data Nutrition Label: Students understand how computing can exacerbate systemic oppression, and learn how to explain bias in a data set comprehensively and concisely.
Collective Obligation: Students understand how the experiences of their ancestors are connected to their communities' current struggles, and develop a sense of responsibility to their community.	Paying It Forward: Students create a data activism activity with the aim of strengthening connections in their community.
Liberation Centered Academic/Achievement Identity: Students recognize the importance of using their academic success to address racism for themselves and their community.	Evocative Audits: Through an arts based activity, students recognize that academic achievement is part of their racial identity despite the racism they and their ancestors experienced.
Activism Skills: Students explain the systems of oppression that need to end, and the new systems that must be built.	Quantifiable Action: Students incorporate the Design Justice Framework [25] into an exploratory data analysis project that addresses systemic racism.

Moreover, Dr. El-Amin refutes the idea that it is infeasible to use education to end racism by stating, "There is no easy path for pursuing racial justice. Thus, this emancipatory framework should not be excluded based on the perceived difficulty to implement the strategy alone." [13]. The liberatory computing framework is practical because schools inherently have a significant role in shaping students' racial identities, their understanding of historical events, and their ability to work in groups.

V. CONCLUSION

This paper conceptualizes liberatory computing. The data activism curriculum teaches students how to use data science to challenge power inequalities, such as racism. This curriculum teaches students how being intentional in their work and using their platform assists them in their careers, whether those are in data activism or elsewhere. Future studies should consider how educators can incorporate liberatory computing and/or data activism to reinforce students' understanding across various subjects. This curriculum will not only assist African American students in transforming society, but all students in computing. While our aim is to begin these liberatory computing discussions in the classroom, they must transfer outside of the classroom in order to truly make a lasting impact.

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