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# SOCIAL JUSTICE DRIVEN STEM LEARNING ( $S_{STEMJ}$ ): A CURRICULAR FRAMEWORK FOR TEACHING STEM IN A SOCIAL JUSTICE DRIVEN, URBAN, COLLEGE ACCESS PROGRAM

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## **Abstract**

*This article presents the curricular framework for a social justice driven STEM curriculum (i.e.,  $S_{STEMJ}$ ) within an out-of-school time program for Boston Public high school students (i.e., College Bound) at Boston College. Starting with a discussion of the authors' ideological positionality within critical social justice discourses, the authors share how Bronfenbrenner's (1994) General Ecological Model provides a conceptual framework for operationalizing social justice inquiry with and through STEM. Positioning this curriculum within the College Bound program's overall design gives readers a sense of how the program's College and Career, Identity and Society, and  $S_{STEMJ}$  curriculums work in tandem to support the programs desired outcomes of students' increased critical consciousness and college matriculation. Lessons learned and future directions are also included in acknowledgement of the necessity of ongoing reflection and adaptation to fulfill the program's ambitious goals.*

## Introduction

Urban students of color living in poverty face systemic oppression daily. From environmental racism causing elevated asthma rates (Brugge, Durant, & Rioux, 2007; Brugge et al., 2013), to unequal access to nutritious food contributing to health inequality (Zenk et al., 2011), to an educational opportunity gap, particularly in relation to STEM (Presidents Council of Advisors on Science and Technology, 2014; Maltese & Tai, 2011) impoverished students of color are at an inherent disadvantage. In a society with a proud rhetoric of equality, these institutional deficits accumulate, and the social debt owed to students of color and their communities increases annually. In relation to education, Ladson-Billings (2006) has coined this perpetual deficit as an educational debt in recognition of the accumulated effect of disadvantage on students of color living in poverty.

In attempts to ameliorate these inequities federal agencies such as the National Science Foundation and the National Institutes of Health have established specific programs with the goal of broadening access to STEM learning experiences for underrepresented students. Acknowledging that many youth opt out of STEM subjects and fields because school-based STEM learning is often seen as uninspiring, confusing, and irrelevant (Millar, 2008 as cited in Villanueva & Hand, 2011), a number of well-designed approaches are underway to create STEM learning environments that build on youth's prior knowledge, experiences, and ways of being and knowing in their communities, with the goal of improving their interest and motivation to study STEM (Tan & Calabrese-Barton, 2010). However, although STEM can be made more relevant and interesting, social injustice is often overlooked as a relevant, lived, and complex reality that oppressed students are already innately motivated to resolve, and which builds upon their and their communities' knowledges and experiences.

As such, in this paper, university-based researchers and practitioners from the disciplines of STEM education and counseling psychology will present a curricular framework for an out-of-school time program, that is, College Bound, where social injustice is illuminated, analyzed, and acted upon with and through the development of STEM knowledge and skills (S<sub>STEM</sub>J). S<sub>STEM</sub>J is a unique approach to STEM learning as social justice inquiry and action drives STEM learning. Although appropriate and important in other contexts, this is different from programs that focus on teaching STEM to close the opportunity gap (although this happens concurrently in S<sub>STEM</sub>J) or teaching STEM in reference to its applicability to illuminating/resolving social injustices. Rather, this program is explicitly designed for students to first to come to understand social injustices within their local communities *with* STEM knowledge and skills and then to act upon these understandings *through* STEM knowledge and skills.

Overall, we aim to explicate how we support a learning environment where students both learn to address larger social injustices and gain the STEM knowledge and skills that Moses and Cobb (2001) have argued is a civil right and potential gatekeeper to college, careers, and full citizenship itself in the 21<sup>st</sup> century. More specifically, within a cohesive program geared towards students' increased knowledge of STEM, college and career, and identity and society, we aim to increase both urban high school students' college access and critical consciousness.

In presenting our curricular framework we will describe the authors' ideological positionalities, the curriculum's conceptual framework, the program's design, and its desired outcomes. Throughout this presentation, examples of how each element of the curricular

framework shapes STEM teaching and learning will be highlighted. Lessons learned and future directions will also be included in acknowledgement of the necessity of ongoing reflection and adaptation to fulfill the program's ambitious goals.

### **Program Description**

Prior to 2009, the College Bound (CB) program's mission was to prepare underserved students for college. In 2009, the program's access-oriented mission shifted towards a more expansive view of social justice that sought to engage students in coming to understand and act upon the roots of systemic oppression. Currently, CB has evolved to include three main program components: Identity & Society, to help students illuminate the historical and material construction of systems of oppression on the macro-level to support the de-internalization of oppression and the development of a positive identity; S<sub>STEMJ</sub>, to help students illuminate and transform local instantiations of systemic oppression through STEM knowledge and skills; and College & Career, to prepare students to matriculate to and succeed in college, and to develop their emerging social justice oriented vocational identities (see Figure 1).

The CB Program engages up to sixty 9<sup>th</sup>-12<sup>th</sup> grade students annually from our partner Boston Public high schools. All of our students will be first generation college students, almost all are students of color, roughly half identify as women, and over half are multilingual. Further, as our recruitment efforts do not target the top performing students, the grand majority of our students are originally "low to middle performing" students who may otherwise not get the attention, resources, or support to matriculate and succeed in college.

Every other Saturday, these students arrive at Boston College to participate in the full-day (8:30 am to 3:00 pm) CB program. In the morning, students participate in S<sub>STEMJ</sub> activities. In the afternoons, students attend their College & Career and Identity & Society sessions.

Instructors from each component, along with the leadership team engage in joint decision-making regarding the implementation and adaptation of the curriculum for the students. As a program with a diverse student population, we understand that each student's context matters. Consequently, we make necessary adjustments to the curriculum as needed as the program progresses. This commitment to serving and respecting the students' identities allows them to actively participate in deep discussions with respect to social justice issues, STEM, and their future careers. Throughout the program students are provided opportunities to give ongoing feedback. In this way modifications, adaptations, and additions to the curriculum can be made, so that not only future students can be directly impacted, but also the current students.

What makes this program unique is that because the mission ties the whole program together, the components parallel and complement each other. The Identity and Society component helps students understand the structures that promote oppression, starting with prompts to reflect on their own historical (past and present) contexts and experiences. Here, the goal is for students to develop a transferable ability to critically analyze the way that institutional and structural power reifies existing inequities. This works reciprocally with the S<sub>STEMJ</sub> component, which also teaches about social justice, but with and through STEM-implicating issues like environmental and food justice. As students are given the opportunity to study issues that may impact their communities directly, their emerging self-efficacy is buttressed by the College and Career component as it helps students see how college and career choices can help them organize their life's energy for social justice. Further, while students are examining who they are and how systems of oppression limit the flourishing of all beings in both of these sections, they are also learning how to access and navigate the educational and societal barriers

that can hold them back from successfully accessing college and attaining a viable STEM or STEM-enabled career within the College and Career Development curriculum.

As a whole, the program provides the youth with the opportunity to be transformative change agents within their community. As the program exposes the youth to societal challenges and provides them with experiential support in finding possible resolutions, students over time begin to realize that they can effect change not only in their schools and communities, but also beyond.

### **Curriculum Framework**

Curriculum development is a process that is rooted in philosophy (Emans, 1966), guided by the contexts and beliefs regarding student learning (Bransford, Brown, & Cocking, 2000), and implemented by teachers. In order to explain how the curriculum came to be, we are explicit in the process in which the curriculum developed. The first section describes the team's ideological positionality. In this section, we thoroughly describe and explain the critical, anti-oppression discourses that guide our approach to programming.

The second section, the conceptual framework, explains how we chose to organize the information in a way that students can readily understand and reflect on. We chose Bronfenbrenner's (1994) Ecological Model to help students understand systemic oppression within a multidimensional context. Third, the program design section illustrates how we implement the program's mission and curriculum. Finally, our desired outcomes of the curriculum are presented with related, anecdotal data.

### **Team Positionality**

CB at Boston College is a program explicitly committed to social justice. As STEM educators and counseling psychology researchers and practitioners of varying social locations committed to social justice, we agree with Rivera Maulucci (2012) that science educators teaching for social justice should clearly articulate both their social and *ideological* positioning. However, because social justice drives STEM in this program, the S<sub>STEMJ</sub> curriculum – though related to what Rivera Maulucci (2011) describes as critical discourses in teaching science for social justice (p. 40) – is ideologically positioned within broader anti-oppressive educational discourses. Specifically, our ideological positioning most aptly fits within the teaching for anti-oppression discourse that Kumashiro (2000) titles: “education that is critical of privileging and othering” (p. 36).

Within this approach to teaching for anti-oppression, educators aim to develop students' “knowledge about oppression and critical thinking skills” so that they can become “empowered to challenge oppression” internally, interpersonally, institutionally, and ideologically (Kumashiro, 2000, p. 37). As such, the program's S<sub>STEMJ</sub> curriculum is designed for students to learn STEM-related content and skills in order to engage and enhance their critical thinking skills for both the purposes of illuminating systemic oppression and empowering them to challenge it within their own communities and beyond. For instance, in relation to institutionalized oppression, students research and document food deserts in local urban communities, and how these food deserts exacerbate institutionalized health disparities (Food Research and Action Center, 2011). In response to this, students learn the mathematics, biology, physics, chemistry, and engineering content and skills necessary to design, build, harvest, distribute, and educate others in their or similar communities about how to grow local, affordable, and nutrient-dense

vegetables with solar-powered hydroponic gardening systems.

In relation to internal, interpersonal, and ideological oppression students come to understand and vocally resist the projected imagery and ways of being within STEM fields, which elevate an emotionally-detached, rationalistic, male, and White embodiment of STEM. Given the historical and present ideological positioning of mathematical and scientific knowledge and skills as the metrics for intelligence and superiority (Semali & Kincheloe, 1999) this projected embodiment needs to be addressed directly if Otherized students (e.g., students of color and women) are not to internalize individual or group-level inferiority.

One critique of this approach to teaching for anti-oppression is that the goal of “empowering” students with knowledge and critical thinking skills may imply that systemically impoverished students of color and their communities are deficient with respect to knowledge and critical thinking skills. This critique is a response to the legacy of “traditional interpretations of Bourdieuean cultural capital theory” which blames systemically impoverished students of colors’ lack of “normative cultural knowledge and skills” as being responsible for their “poor academic performance,” while absolving larger systems of power and privilege (Yosso, 2005, p. 70).

Instead, we believe that STEM educators need to grapple with how to engage, build from, and connect students’ “community cultural wealth” when teaching STEM knowledge and skills (Yosso, 2005, p. 77). Yosso (2005) defines “community cultural wealth” as “an array of knowledge, skills, abilities and contacts possessed and utilized by Communities of Color to survive and resist macro- and micro-forms of oppression,” which can be used to “transform education and empower People of Color to utilize assets already abundant in their communities” (pp. 77, 82). These abundant assets are undergirded by “at least six forms of capital such as aspirational, navigational, social, linguistic, familial, and resistant capital” (p. 77).

Within our program STEM educators are encouraged to tap into students’ “aspirational capital,” whereby students continue their communities’ legacy of seeking ambitious solutions to seemingly insurmountable systemic problems, for example, systemic health inequality (Yosso, 2005). With these ambitious goals, students are encouraged to use their “linguistic capital” and “social capital” to mobilize school and community members to support their social justice efforts through and with STEM. In conjunction with school and community members, students leverage their “familial capital,” rooted in their communities’ ways of knowing and being and their expanded notion of family/community, and their newly acquired STEM knowledge and skills, to co-create new possibilities for the well being of all beings (Yosso, 2005, pp. 79-80). In grappling with actualizing these new possibilities, STEM educators are implored to engage students “resistant capital,” that is, the “knowledges and skills fostered through oppositional behavior that challenges inequality” to help sustain long term engagement with social change in the face of adversity (Yosso, 2005, p. 80).

Collectively, the aim is to engage students as reflective, illuminating, co-participants who can navigate institutional and ideological barriers to support anti-oppressive work by intertwining their STEM capital with their cultural community wealth. It should be noted that, although we acknowledge the multiplicity of knowledges and the culturally-mediated approaches to science, we also understand the necessity of Otherized students to code-switch into normalized, Western scientific discourse to navigate material barriers to survival, for example, standardized tests, college, public hearings, etcetera (Apple, 2008). This calls upon both students and teachers to become increasingly multi-lingual and multi-epistemic in our pursuit of new possibilities within the materiality of oppression.

## **Conceptual Framework**

Using the team's positionality with regards to social justice (see Figure 1), we wanted students to have an introspective understanding of the world they live in in order to be agents of transformation within it. In order to reflect this in the curriculum, we utilized Bronfenbrenner's (1994) *General Ecological Model*.

This theoretical framework was written to offer a new theoretical perspective (ecological) of human development. In his model, Bronfenbrenner (2009) depicts the "conception of the developing person, of the environment, and especially of the evolving interaction between the two" (p. 3). He assumes that an individual continuously interacts with the environment, and that this interaction informs what and how something is learned. What is particularly unique about his model is that he fuses tangible objects and settings (such as houses and schools) with intangible concepts such as culture and politics, and relationships:

Within any culture or subculture, settings of a given kind—such as homes, streets, or offices—tend to be very much alike, whereas between cultures they are distinctly different. It is as if within each society or subculture there existed a blueprint for the organization of every type of setting. Furthermore, the blueprint can be changed, with the result that the structure of the settings in a society can become markedly altered and produce some corresponding changes in behavior and development. (Bronfenbrenner, 1994, p. 4)

Furthermore, Bronfenbrenner (2000) stresses that in order for developmental influences to be visible, there needs to be a model for students to be able to observe what these influences are. Because of this, we chose his framework to slowly expose students to the various systems that interact with them so that they can produce long-lasting changes in their broader community.

This model depicts how different peoples' beliefs, culture, and identity are shaped by the different systems with which they frequently interact. The microsystem is,

a pattern of activities, social roles and interpersonal relations experienced by the developing person in a given face-to-face setting with particular physical, social, and symbolic features that invite, permit, or inhibit engagement in a sustained, progressively more complex interaction with, and activity in, the immediate environment. (Bronfenbrenner, 1994, p. 39)

Included in this system are settings such as the school, family, peer group, and workplace.

The next system—the mesosystem—consists of the interactions between two or more settings in the microsystem such as the home and the school. The third system, the exosystem,

comprises the linkages and processes taking place between two or more settings, at least one of which does not contain the developing person, but in which events occur that indirectly influence processes within the immediate setting in which the developing person lives. (e.g., for a child, the relation between the home and the parent's workplace). (Bronfenbrenner, 1994, p. 40)

The macrosystem is the pattern of combined micro-, meso-, and exosystems of a culture or subculture in relation to beliefs, knowledge, and economics. Finally, the chronosystem,

encompasses change or consistency over time not only in the characteristics of the person but also of the environment in which that person lives (e.g., changes over the life course in family structure, socioeconomic status, employment, place of residence, or the degree of hecticness and ability in everyday life). (Bronfenbrenner, 1994, p. 41)

The different systems in Bronfenbrenner's (1994) ecological model provide students with a comprehensive understanding of the varying aspects of society that they affect and are affected by. Because of this, the progression of the STEMJ curriculum initially begins with the self and moves outwards towards interconnected, society-level systems of oppression to help students build both a STEM and social justice oriented identity.

Locating identity development within a social system is consistent with a conceptualization of identity as enacting certain behaviors, ideas, and ways of relating in order to be recognized as a particular type of person (Farnsworth, 2010). However, this is not to say that sociopolitical identities such as race, gender, and class are fluid markers that students can choose to take up or put aside. These aspects of one's identity, although socially constructed, are historically and materially connected to "structural causes and material relations that create 'difference'" for the purposes of hierarchical stratification for dispossession (Grande, 2015, p. 159). Understanding that one's identity is influenced by an unjust society may allow young people to deconstruct the network of social relations from which identity and subjectivity continuously emerge. In doing so, students' ability to grapple with what DuBois (1907) termed a "double consciousness," which in broader terms names the identity paradox of subordinately positioned peoples who need to know how they are constructed by superiorly positioned peoples as less than, while understanding who one is and who one can become. Grappling with this paradox is critical for students who wish to engage with identities previously viewed as unavailable to them, such as, a social change agent or STEM person.

One example of how Bronfenbrenner's (1994) ecological model is put into practice is with our 11<sup>th</sup> and 12<sup>th</sup> grade food justice STEMJ curriculum. As such, when working on the problem of food injustice, students start with the microsystem, reflecting on what they eat day-to-day and learning the necessary biology and nutrition to assess how their diet may be impacting their long-term health. As students discover both what is healthy and unhealthy in their diet they naturally begin to question why, within the mesosystem of their school and family, they are eating food that may be deemed unhealthy.

Consequently, student angst is channeled into uncovering causes of poor nutrition and patterns of an oppressive exosystem begin to emerge. Using mathematics, they uncover lower prices, but higher calories per pound between potatoes chips and potatoes; higher average prices at smaller convenient stores, especially for the most nutritious food; and the plethora of these stores in impoverished communities. Further, the contradiction of the most impoverished communities needing the most expensive transportation options (i.e., a car or cab) to get to the most affordable food vendors is illuminated as students learn how to use geographic information systems (GIS). As such, students are able to employ technology to map the presence of "food deserts," that is, geographic areas without access to affordable and nutrient-dense food.

Quickly students are able to connect their understanding of how this oppressive exosystem, that is, food deserts, limits the nutritional quality within their micro- and meso-systems. Seeing the relationship between these multiple systems facilitates their comprehension of how oppressive macrosystems operate. Further, students readily connect how food deserts

interact with unequal access to high-quality health care to further exacerbate health disparities by race and class. Finally, students learn about how this interacts on the chronosystem level by organizing and tracking data about how demographics, income, and food production have changed over time, and how this contributes to oppressive conditions.

Collectively, as students progress and oscillate through this ecological model they are asked to reflect on how oppression operates on internal, interpersonal, institutional, and ideological levels. For example, students discuss how national nutrition campaigns targeted at schools and communities with less access to affordable and nutritious food obscures the institutional forces that have produced food deserts, creating a damaging false-illusion of self-determined negative health outcomes, which consequently dampens resistance.

Moving beyond critique, as students increase their awareness and understanding of systemic oppression, they are offered ways to move towards action to improve society. For example, in relation to the food deserts, students suggested creating a market in these areas, which led our project staff to examine ways to support the youth in reaching their solution. This work soon led to a hydroponic food project (growing food with water and minerals as opposed to soil) in which the youth grow produce that they then sell at local farmers' markets. To advance this project, students began designing and creating solar-powered hydroponic garden systems in order to produce and distribute local, affordable, and nutrient-dense food that can be grown on barren land, concrete backyards, or roof tops. In an effort to make this a sustainable social enterprise, students learned the biology, chemistry, mathematics, physics, technology, engineering, business, economics, and education skills necessary to design, create, market, manage, and sustain their endeavor.

As illuminated, the conceptual framework of the S<sub>TEM</sub>J curriculum clearly supports the program's goal of increasing students' critical consciousness, as they learn STEM skills and knowledge while leverage their community cultural wealth to move from increased awareness of food deserts to increased efficacy towards resolving them, and finally to action. Although seemingly indirectly related, it has been our experience that this process also motivates and empowers students to pursue and access college, which is the program's other key objective.

As students' feelings of empowerment increases, their increased interest in planning for college and careers seems to increase. Students begin to articulate college and careers as vehicles for promoting their vocational interests in social transformation. As opposed to college as an abstract and external goal that disconnects students from their communities' ways of knowing and being, attending and graduating from college becomes a highly personal goal directly connected to their desire for increased well being for their community and beyond.

### **Desired Outcomes**

As mentioned previously, the program's desired outcomes are both the development of critically conscious students and their successful matriculation to two-year or four-year colleges (see Figure 1).

The process for developing critical consciousness is based on Freire's (2007) theory that through a dialogical approach to fostering critical literacy, individuals gain understanding of the societal conditions that impact their lives, and because of this new understanding, take action to change their world. Watts, Diemer, and Voight (2011) identified three components of critical consciousness: critical reflection, political efficacy, and critical action. These components correspond with the grade-level progression in the CB curriculum for developing an activist identity. That is, facilitators work with 9<sup>th</sup> and 10<sup>th</sup> graders to develop critical reflection, 11<sup>th</sup>



graders to develop political efficacy, and 12<sup>th</sup> graders to develop and sustain critical action. Although critical consciousness is not conceived of as a developmental or stage model, and theoretically, these three components emerge reciprocally, scholars (Watts & Hipolito-Delgado, 2015) have noted that facilitating critical action is generally more difficult than critical reflection. With this in mind, our framework seeks to build critical reflection and political efficacy first, with the presumption that students are more likely to take social action if they know what they want to change and how they want to change it. Finally, even though activities are primarily tailored to one component of critical consciousness each year, facilitators and program administrators embed opportunities for reciprocal development of all three components throughout the life of the program. For example, while students in grades 9-10 learn how to analyze data from air quality sensors to expose the causes of differential asthma rates by race and class, students in grades 11 (after exposing the presence of food deserts using GIS) develop a sense of political efficacy as they are mentored by students in grade 12 who are engaging in critical action to transform food deserts through hydroponics.

Qualitative content analysis of semi-structured interviews presented evidence of students' development of critical reflection, political efficacy, and critical action within the program (Kozan et al., in review). As designed, although there was evidence of students' critical reflections throughout the S<sub>TEM</sub>J curriculum, they found the strongest evidence of students' increased political efficacy and movement towards critical actions in grades eleven and twelve within the food justice curriculum (Kozan et al., in press). Interestingly, they also illuminated connections between students increased feelings of empowerment with their increased interest in planning for college and career, which they hypothesized to be mediated by students' increased sense of vocational purpose driven by their desire for social transformation (Kozan et al, in press). Even with these hopeful findings, longitudinal qualitative studies are desired to illuminate how this critical consciousness fostered within CB manifests itself during and after college.

Beyond this qualitative content analysis, the authors of this article have consistently heard students claim that: (1) they want to meaningfully give back to their community, and (2) they want to learn how to solve social and environmental justice challenges that affect their neighborhoods. In fact, it was our high school students work in using geographic information system technologies to explore environmental justice issues in their own neighborhoods that students realized the existence of food deserts to which they proposed using hydroponic gardening to provide affordable and locally grown greens to their communities.

In relation to college access we have had a 100% college attendance rate with 3 Gates Millennium Scholars in the past nine years. In addition, we have been trying to track our students who participated in our program and of the 75 graduates we have tracked 41 are still majoring in a STEM field in college. This is significant in light of the National Science Foundation Indicators (2010), which provided evidence that although the proportion of Blacks (5%) and Hispanics (5%) have increased in nonacademic science and engineering occupations positions, they are still much lower than the general population. In many ways we believe that this reflects students' connection with STEM as a vehicle for social change.

Although objectives related to critical consciousness, college, and career within the context of gendered and racialized global capitalism may seem contradictory from the perspective of a Marxist critique, they are quite harmonious from the perspective of oppressed students within our program. Our students have seen firsthand how their skills and knowledge, which could be further developed in college, could contribute towards social transformation and

as such have felt vocational callings towards these ends. The pursuit of a college education and a career can be for the purpose of justice, as it can be for the purposes of injustice. Rarely though, is life so binary. Rather, systems of oppression are longstanding and complex, and their resolution will require long-term commitment, rigorous preparation, careers that can sustain action and survival, and a diversity of skills and occupations (some of which are STEM-related).

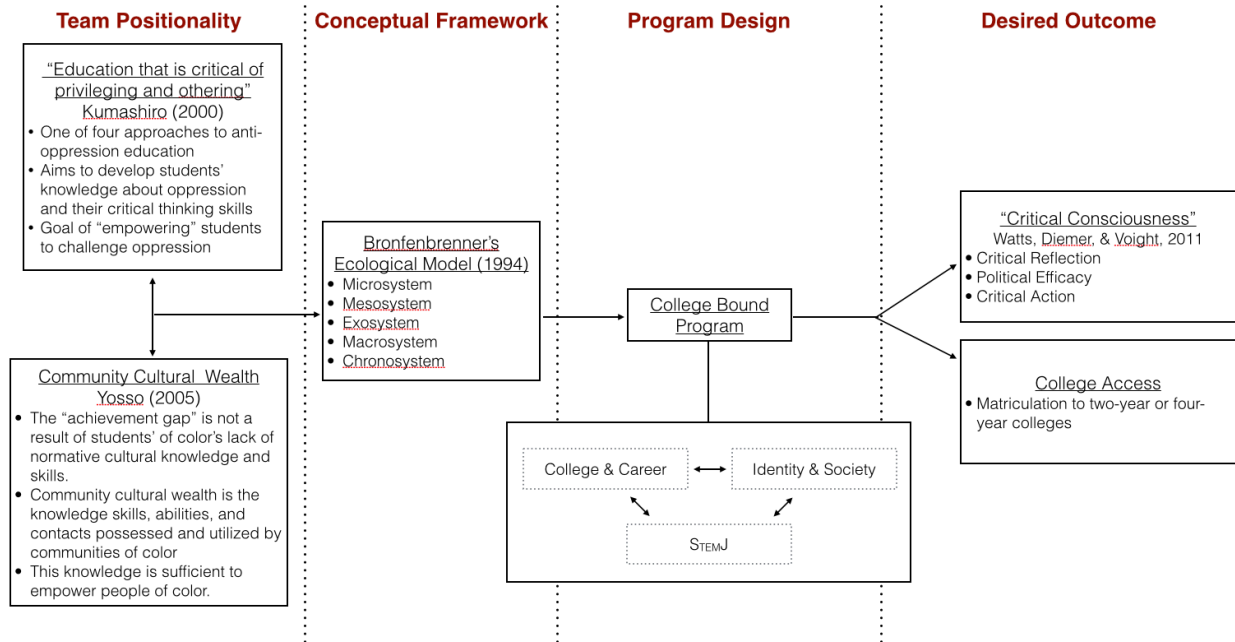


Figure 1. CB curriculum framework

### Lessons Learned

Since 2009 there have been a few key lessons learned that have, in our humble opinion, enhanced the STEMJ curriculum's vitality. Below are suggestions that may be helpful for other programs who seek to implement a similar curricular model.

#### Allow Time and Provide a Community for Students to Develop Their Critical Consciousness

Participating in deep discussions about systemic oppression does not happen instantaneously. Many students have internalized their social conditions as innate to their communities and/or sociopolitical groups, often blaming themselves and their communities for their systemic oppression (Helms, 1995), and generally unconvinced that they can be agents of change. For example, although students of color may have greater epistemic purview in relation to systemic racism (given its visible effects on their life choices and circumstances), the internalization of racial inferiority necessitates coming to understand one's experiences as connected to material, structural forces which, despite their individual agency, shapes the options and choices of individuals in such a way that, on the whole, replicate inequality (MacLeod, 2008). Moreover, few students are immediately ready or comfortable to share their personal experiences to adults and peers whom they are unfamiliar with. As such, we have found that trust

formation, through a safe socio-emotional learning environment is a necessary first step. Learning this lesson means that teachers must engage students in activities that promote a sense of community before they can engagement develop their critical consciousness.

### **Engage Student Leaders and Alumni Leaders**

One of the CB program's strengths is its engagement of student leaders and alumni. While most college access programs track their graduates' college matriculation and completion rates, CB continuously reaches out to alumni to enhance our students' experiences. With varying amounts of engagement, some alumni act as guest speakers, sharing their college experiences, while others serve as alumni leaders who work with our instructors, helping to facilitate group activities, support individual students, and even plan lessons. We have found that when students see and engage with someone young who looks like them and who has had similar experiences as themselves, they are more willing to participate in personal and intense conversations about systemic oppression. In addition, as college students they serve as role models, sounding boards, and guides for our students, all of whom are first-generation college students, who greatly appreciate their navigational capital.

### **Bring in Community Activists and STEM Professionals**

In an effort to expand CB students' knowledge about systemic oppression and its manifestations locally, nationally and globally, the College Program has incorporated opportunities for CB students to hear from college students, community activists, and STEM professionals who engage in social justice work. Their lived, concrete examples increase students' ability to imagine how their increased critical consciousness, in tandem with college completion, can create new possibilities for mutual well being. In particular, we have found that students, although always engaged, are particularly motivated to explore a potential career if someone with a similar background to them has shared their work, college going, and social justice experiences with them. This personal identification with a guest seems to trigger a feeling of vicarious self-efficacy and instills a sense of vitality and urgency to our collective work that is miraculously beautiful.

### **Allow Space for Healing and Reflection Resulting from Current Events**

While we are confident in the program's design and curricular components, we recognize the importance of illuminating current instantiations of systemic oppression, especially the ones that are weighing heavily on students minds and hearts. Pausing the curriculum to discuss instances of injustice that impact our students lives, such as, police brutality, its connection to systemic racism, and the Black Lives Matter movement's responses to systemic violence enacted against Black bodies, is important to building a community of trust. Students and staff need to vent their frustrations, share their insights, pose questions, and sometimes share similar experiences. Listening and facilitating these community discussions has not always been comfortable, but allowing space for vulnerability deepens trust and a feeling of community. Further, in our experience, we have found that these sessions help students process how these events are instantiations of systemic oppression, which is not only illuminating, but seems to increase students' sense of political efficacy. In turn, this increased political efficacy seems to re-energize their emerging college and career interests related to their social justice oriented vocational identities.

### **Future Directions**

The CB program started in 1987, as a collaboration between Boston College and the Boston Public Schools. The intent of the program was to identify students who were struggling academically and socially, and offer them an integrated program of academic and social support. Over the years, the program has evolved to respond and adapt to an ever-changing society. In 2007, an important shift from a subject-based academic enrichment, college-preparation program to a social justice and critical inquiry focused program occurred. In 2009, it expanded to a four-year program starting in the 9<sup>th</sup> grade, adding a STEM component in recognition of STEM's importance to advancing social justice both individually and collectively. Since this time we have continuously revised what it means to have STEM within a social justice oriented program. Social justice driven STEM (S<sub>STEMJ</sub>) is our most recent iteration.

Over the next few years, the CB program will expand to include 7<sup>th</sup> to 12<sup>th</sup> grades. We believe that earlier intervention in relation to both critical consciousness and college access is important and necessary. In our experience it takes at least two years for students to significantly develop their critical consciousness and college readiness; for most students this is their junior year, which in relation to college access is far too late.

By adding the middle school grades, teaching for social justice with and through STEM will expand and change. Our students are interested in coding and robotics, which is reflective of these technologies increased presence within our realities. Arguably, understanding these specialized technologies are increasingly critical to full participation in our society, and as such mirrors the motivation behind Moses and Cobb's (2001) earlier call to acknowledge STEM knowledge and skills as a civil right.

Thus, although we are not sure how coding and robotics will ultimately be brought to serve social justice within our program, we believe our students need and should have access to this increasingly important knowledge and skills. Nonetheless, we are confident that together we can uncover what is possible. Our students' material experiences with social injustices in combination with their community cultural wealth have always helped us to teach for social justice with and through STEM. As always, our learning is reciprocal. Throughout this process, our team will constantly examine and re-examine what it means to promote social justice driven STEM learning, and how we can reflect that in the program and implement it throughout the curriculum.

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