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Designing Mathematics Curricula that Center Students' Brilliance

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Abstract

Building on Black Feminist Mathematics Pedagogies (BlackFMP; Joseph, 2021), we aim to understand how curriculum can center the brilliance of particularly marginalized students—those who are marginalized (i.e., de-centered) by multiple forms of oppression. The BlackFMP framework centers the intersectional experiences of Black girls within the United States' colorblind school system. Building on theory and prior research, BlackFMP situates Black girls' individual experiences within a social and historical context. BlackFMP orients us to the brilliance of Black girls in the United States as one case of particularly marginalized students in the global community. Using the BlackFMP framework, we analyzed a lesson from a published middle school mathematics curriculum for how it attends (or not) to multiple dimensions of BlackFMP: academic and social integration, robust mathematics identities, and critical consciousness and reclamation. Our analysis then supported us in offering ways to redesign the lesson to facilitate increasingly equitable mathematical experiences. We argue that using a framework that centers a particularly marginalized population, such as the BlackFMP framework, can create learning opportunities for curriculum designers internationally as they explore ways to create textbooks that have equitable learning opportunities for the populations they support.

Introduction

Broadly, we aim to understand how curriculum can center the brilliance of *particularly marginalized students*—those students who are marginalized (i.e., de-centered) by multiple forms of oppression, such as classism and heterosexism—rather than centering whiteness and heteronormative masculinity. In particular, we focus on centering the brilliance of particularly marginalized students in mathematics curricula. Though mathematics is a subject steeped in whiteness (Battey & Leyva, 2016; Ernest, 1991) and heteronormative masculinity (Esmonde, 2011; Leyva, 2017; Mendick, 2003, 2006) throughout the world, mathematics is often assumed to be a subject that is culture-free and politically neutral. Yet, whiteness is a global phenomenon, impacting marginalized learners and communities regardless of the racial and ethnic makeup of nations and communities (Leonardo, 2002). In addition, the United Nations (2023) Sustainable Development Goals call on educators to eliminate gender disparities by ensuring equal access to all levels of education and vocational training (Goal 4). Mirroring the global society, mathematics classrooms worldwide are not only racialized spaces but are also

gendered, resulting in inequitable educational experiences and achievement patterns (Leyva, 2017) and making girls of color a particularly marginalized population the world over. As such, calls for curriculum designers to dismantle unjust mathematics learning opportunities are being made in countries around the world. Internationally, these calls are taken up by coalitions of mathematics educators committed to building better, more equitable and just futures with mathematics (e.g., Graven et al., 2021; International Commission on Mathematics Instruction, 2023) and to better understanding the social and political dimensions of mathematics education (e.g., Mathematics Education and Society, n.d.).

In our context, the U.S. educational system, describing mathematics as neutral or culture-free aligns mathematics with the dominant social discourse of white cultural practices, ignoring the experiences, cultures, and traditions of marginalized communities in mathematics (Harper et al., 2020). Consequently, there is a lack of explicit resources for designing for equity and social justice in mathematics materials, particularly for designing for equity in ways beyond creating contexts that resonate with students' lives. To address this lack of explicit resources for curriculum designers, we build on research that attends to the individual experiences of particularly marginalized students and also situates those experiences within a historical context to inform the design of mathematics curriculum materials. Because we are situated within the U.S. context and its history of systemic racism, we draw on research that (a) is conducted by Black, Indigenous, and People of Color (BIPOC) academics and (b) centers the brilliance of BIPOC students (e.g., Leonard & Martin, 2013). Traditionally, brilliance in mathematics is defined through meritocracy and hegemonic principals, values, and ideals, with the majority of scholarship on Black students in mathematics focusing on failure, underachievement, and the "achievement gap" (Russell, 2013). By analyzing curriculum materials with a framework that centers Black girls as a particularly marginalized population within the U.S., we recognize opportunities to disrupt the status quo of mathematics education steeped in whiteness and heteronormative masculinity in order to design mathematics curricula that foreground Black brilliance. Our aim is to enable designers in varied contexts to reconsider their ideas about mathematics. Thus, we ask: *How can the design of mathematics curriculum re-orient teaching and learning toward the needs of particularly marginalized populations in their communities?*

Conceptual Underpinnings

The U.S. educational system acts as an agent of cultural and ideological hegemony, serving as a powerful agent of economic and cultural reproduction, reflecting the perspectives and beliefs of the dominant class, with mathematics classrooms operating as a white institutional space, providing a key role in reproducing or disrupting race, class, and gender hierarchies (Apple, 2004; Martin, 2010). We build on existing U.S. mathematics education reform efforts of ambitious instruction (e.g., Lampert et al., 2010), acknowledging that they are necessary but insufficient, as evidenced by over three decades of research and curriculum that have not led to a meaningful shift toward equitable outcomes, particularly for Black learners in the United States (Berry et al., 2014; Bullock, 2019; Martin, 2010). Marginalized students in the U.S. continue to receive unequal opportunities, such as less experienced teachers, lower expectations, less funding (Carter & Welner, 2013; Flores, 2007), and mathematics curricula that are saturated in whiteness (Battey, 2013; Bullock, 2017; Martin, 2010).

Understanding Whiteness to De-center It

As a culture, whiteness is toxic in society and in education because (a) its ways of being have become so normalized that they are difficult for those who participate in them to name or identify (Leonardo, 2009; Picower, 2009; Sleeter, 2001), and so (b) they are used as expectations for interaction without being intentionally chosen (Baldwin et al., 2021; Okun & Jones, 2000; Okun, 2021). The normalization of white culture's characteristics as the *best* and *right* ways of being (i.e., white supremacy culture) has led whiteness to be described as "the unwillingness to name the contours of racism, the avoidance of identifying with racial experience or group, the minimization of racist legacy, and other similar evasions" (Frankenberg, 1993, p. 23). To be more specific, in society more broadly whiteness presents through norms including but not limited to perfectionism, a sense of urgency, individualism, and objectivity (Okun & Jones, 2000; Okun, 2021). Whiteness can present as *objectivity*, for instance, through impatience around thinking that is not "logical" or "rational" (according to existing power structures), or beliefs that emotions are detrimental to decision-making processes. It is easy to see how these white societal norms have made their way into U.S. and international educational practices. A highly influential toolkit for disrupting racism in mathematics education in the U.S. (Baldwin et al., 2021) outlines some specific ways that such white culture norms manifest in mathematics education in particular, including but not limited to:

- having a greater focus on getting the "right" answer than understanding concepts and reasoning;
- valuing independent practice over teamwork or collaboration;
- curriculum developers and teachers enculturated in the U.S. teaching mathematics the way they learned it without critical reflection;
- offering superficial curriculum changes in place of culturally relevant pedagogy and practice; and
- expressing rigor only in relation to difficulty.

Understanding how white culture manifests in education matters because the requirement to participate in white culture can be harmful to BIPOC by adding an additional burden. For example, mathematically successful Black men report managing the burden of navigating white spaces and maintaining their Blackness by resisting pressure to assimilate to white ideals (Stinson, 2011). In mathematics classrooms, BIPOC students are too often required to take on additional emotional labor compared to that required of white students. As such, BIPOC students must manage persistent fears of confirming racialized stereotypes of who is mathematically capable (McGee & Martin, 2011) and the increased emotional labor of silencing their pain and outrage when they experience racism in the classroom (Battey & Leyva, 2016). White supremacy culture's expectation of conflict avoidance (Okun & Jones, 2000; Okun, 2021) makes such expressions of pain and outrage by BIPOC unacceptable in classrooms that adhere to white norms, thus reinscribing white supremacy culture's toxicity in the mathematics classroom.

Heteronormative Masculinity in Mathematics Classrooms

Because mathematics classrooms are also spaces dominated by the overvaluing and normalization of heteronormative masculinity, students of all genders (including those outside the gender binary) who do not perform masculinity in mathematics in Western, white, heteronormative ways are also marginalized, having an extra burden placed on their efforts to feel both a sense of belonging and competence (Leyva, 2017). Thus, it is essential

to challenge the business-as-usual mathematics curriculum design by starting with an asset-based approach that decenters whiteness and heteronormative masculinity and instead works to center those identities that have been pushed to the margins of society and the mathematics classroom.

Black Girls as a Case of Particularly Marginalized Students

In the mathematics classroom, inequities against Black students are created and perpetuated by the delegitimization of their mathematics ability (Harper et al., 2020; Martin, 2007). This inequity of marginalized students is not unique to the U.S. and plays out in many countries around the world (e.g., Akiba et al., 2007; Rolfe et al., 2021). As such, despite reform efforts focused on reaching *all* learners and centering *rigor* and *equity*, marginalized students continue to be systematically excluded from mathematical spaces (Gutstein, 2009; Martin, 2003). Equity-oriented reforms have failed to respond to Black oppression and dehumanization because these reforms are rooted in the appeal of white benevolence and the promise of not altering the status quo (Martin, 2003). For example, focusing on "all" students without explicitly attending to the lived experiences of marginalized students in mathematics classrooms has a colorblind (i.e., a form of racism that denies differences in privilege and oppression based on race; e.g., "I don't see color. I don't care if you are pink, purple, or polka-dotted") impact (Ernest, 1991), making BIPOC brilliance invisible by whitewashing standards for mathematical smartness (e.g., with notions of individualism rather than collectivism and familiality; *A Pathway to Equitable Math Instruction*, 2021; Okun & Jones, 2000). Indeed, many reform efforts serve the interests of dominant groups (i.e., interest convergence), national safety, and economic and educational advantage (Martin, 2003). To push back against this trend, we choose to use a framework centering Black girls in order to reimagine math curricula that disrupt the persistence of whiteness in math education.

Across the African diaspora, Black girls are oppressed in a unique way due to their race and gender, being positioned as outsiders and rendered invisible within mathematics (Butler-Barnes et al., 2021; Young et al., 2017). Thus, as a case of particularly marginalized students, Black girls experience intersectional forms of oppression, including sexism and the U.S.'s ongoing history of anti-Black racism and violence against Black people. Anti-Black racism happens in schools in many ways, including through the adultification of Black girls (i.e., the belief that Black girls need less nurturing, protection, and support than white[1] girls); the characterization of Black girls as too social, loud, and disruptive; disproportionate discipline; and resistance to naming Black girls' intellect even when they excel, to name a few (Epstein et al., 2017; Joseph, 2021). By centering Black girls, we work to counter the deficit narratives surrounding Black girls in mathematics. Even more, the history and ongoing practice of centering white or Asian students in the U.S.'s mathematics education research continues to push Black girls to the margins of society in general and education in particular. Because anti-Blackness is one of the most predominant and visceral forms of racism in America (i.e., an extreme case, Flyvbjerg, 2006), attending to the experiences of Black girls should benefit all students and teachers in the U.S., and abroad.

Despite increases in research on Black girls and their experiences in mathematics in the last decade, much of the current research based in the United States frames Black girls through a deficit lens, as underachievers who possess inferior abilities when compared to white and Asian students (Ladson-Billings & Tate 1995; Moses-Snipes & Snipes, 2005; Reyes & Stanic, 1988; Tate, 1997; Gholson & Martin, 2019), while international research is focused on Black girls' experiences comparatively (e.g., Rollock, 2007) or narrowly focused on classroom experiences rather than curricula (e.g., Brown et. al, 2008). With so much of

educational research on Black girls being conducted through comparative analysis (Gholson & Martin, 2019), centering Black girls and their experiences without comparison allows us to spotlight their brilliance in mathematics. Our focus on Black girls is an explicit response to calls to action for antiracist (e.g., TODOS, 2020), humanizing, and just mathematics instruction (e.g., Gutiérrez, 2018). Because of this, we draw on scholarship about the experiences of Black girls to re-imagine mathematics curricula.

The Significance of Published Curriculum Materials

We argue that published curriculum materials are essential for combatting oppression in the classroom: they are used in diverse classrooms throughout the U.S. and the world, and research has shown that published mathematics textbooks significantly impact instruction and students' experiences in the classroom (Kloosterman & Walcott, 2010). Still, many equity-oriented frameworks for mathematics education have been developed to reimagine mathematics teaching (e.g., Aguirre & Zavala, 2013) or to support consumers (e.g., CCNetwork, 2020) rather than to support career *curriculum designers* — going forward, those who author published textbooks and their related materials. Yet, because of the impact of published curricula on students' experiences, curriculum designers need resources to support their ability to disrupt unjust systems that uphold the status quo in mathematics education worldwide. Thus, in this paper, our inquiry into the design of mathematics curriculum materials is narrowed to published curricula, and so when we say *curriculum materials*, going forward, we refer to published curricula unless specified otherwise.

We acknowledge that, in many respects, a focus on teaching over curriculum makes sense. After all, curriculum is not limited to textbooks ordered from large-scale publishers, but more broadly includes the tools, experiences, key ideas, and decisions that teachers and students engage with in their lessons (Remillard & Heck, 2014). With this expansive definition of curricula, a focus on the work of teaching makes equity-oriented frameworks more accessible to those who author curricula in this broader sense: teachers. Yet, the impact of published curriculum materials should also not be ignored. In our inquiry into published curriculum materials, we draw from a framework for mathematics pedagogies that articulates how mathematics teaching can benefit from centering the lived experiences of Black girls.

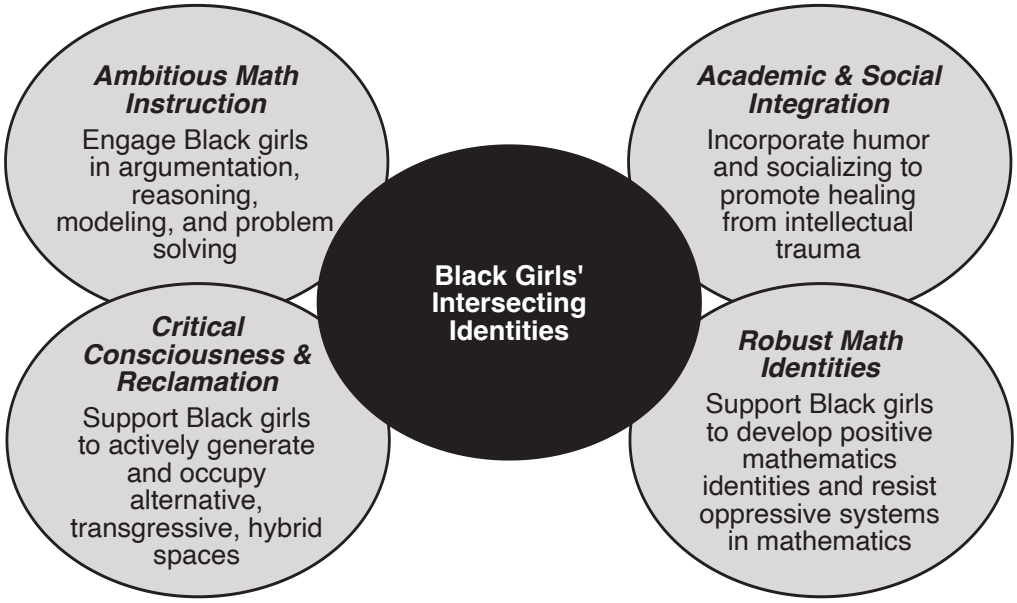
We use this framework—Black Feminist Mathematics Pedagogies (BlackFMP, Joseph, 2021)—to analyze and reimagine lessons within a published and widely adopted reform-based secondary mathematics curriculum. By reform-based, we mean that the curriculum was designed to support ambitious mathematics instruction (Lampert et al., 2010) and culturally responsive teaching (Gay, 2018; Hammond, 2014). We chose a pedagogical framework to guide our curriculum analysis because curriculum's influence on instruction (Kloosterman & Walcott, 2010) requires curriculum designers to pay close attention to the pedagogies they wish to support. Thus, in this paper, we ask more specifically: *How can Black Feminist Mathematics Pedagogies, one framework for centering Black girls' mathematical experiences, help curriculum designers understand how mathematics curriculum materials do and do not support humanizing and just teaching?* By taking up BlackFMP, our analysis of curriculum materials inherently attends to the experiences of Black girls.

Theoretical Framework

Building on Crenshaw's (1989) theory of intersectionality, Joseph's (2021) BlackFMP describes principles that support mathematics instruction to be designed in ways that are affirming for Black girls. *Intersectionality* explains that attending to only one dimension of a person's identity (e.g., race, gender, or class) hides the realities of intersecting forms of oppression. For example, Crenshaw illustrated a case in which a motor vehicle company discriminated against Black women, but the courts did not recognize the discrimination since the company could prove that it did not discriminate against women (i.e., it had hired *white* women) or Black people (i.e., it had hired Black *men*). This case demonstrates that the courts allowed white women to represent *all* women and Black men to represent *all* Black people since references to single identities (e.g., female) elicit assumptions of other, dominant characteristics (i.e., assuming the female is white and heterosexual since not otherwise stated). This phenomenon made discrimination against Black women invisible, requiring an understanding of how the intersection of identities results in compounding forms of oppression for individuals; thus, intersectionality is about identities, power, and oppression.

This intersectional perspective buttresses Joseph's argument that supporting equitable mathematics experiences for Black girls requires attending to the ways identities and content are manifested within mathematics curriculum materials. In order to expand our collective vision of equitable mathematics education for Black girls as particularly marginalized students, Joseph defines four dimensions of BlackFMP: *ambitious mathematics instruction*, *academic and social integration*, *robust mathematics identities*, and *critical consciousness*. As shown in Figure 1, intersectionality lies at the center of the four dimensions. The center of Figure 1 accounts for how everyone, including Black girls, has dimensions of their identity that influence how they experience the world, whether they are conscious of them or not, including language, sexuality and gender, disability, femininities and masculinities, religion and culture, and class. There are many more dimensions of our identities, but these dimensions often signal dominance and oppression, with historically dominant identity markers (e.g., male, heterosexual, white) conferring unearned privileges (e.g., assumptions of competence and good intentions). As illustrated in the (Re)designing section, mathematics curriculum materials can challenge patterns of intersectional oppression by challenging dominant narratives along the dimensions of BlackFMP.

Figure 1: The dimensions of BlackFMP, adapted from Joseph (2021, p. 87)



Ambitious Mathematics Instruction

BlackFMP argues that teaching for equity and social justice requires *ambitious mathematics instruction*—teaching that engages students in argumentation, reasoning, modeling, and problem-solving—and that though it is necessary, it is also insufficient. Curricula have a strong influence on whether teachers are able to engage in ambitious instruction because ambitious instruction requires, at a minimum, rich tasks to ground lessons (Stein et al., 2009). For example, if mathematics curriculum materials do not have tasks of high cognitive demand, whether of the caliber of *doing mathematics* or using *procedures with connections* (Boston & Smith, 2009), then they are unlikely to be engaging for students or support mathematical sensemaking.

Ambitious mathematics instruction features high cognitive demand tasks, supports students in making sense of problems, provides structures to encourage equitable participation in mathematical practices, makes room for productive struggle, uses teaching strategies that not only foster positive relationships between teachers and students but also between students themselves, and also requires teachers to make sense of students' thinking as a means to build towards canonical understandings. Beyond providing rich tasks, curricula can support teachers in engaging in ambitious mathematics instruction by embedding resources such as mathematical language routines to support students' sensemaking (Zwiers et al., 2017), status treatments to support students with low mathematical confidence to experience success (Cohen & Lotan, 2014), and strategies for teachers to monitor students' thinking during small group work (Horn, 2012). Because reform efforts centered on ambitious instruction have not led to significant shifts in educational outcomes for marginalized students, Joseph (2021) describes three additional features of instruction that explicitly attend to equity issues in mathematics which she argues are critical to the design of curriculum materials.

Academic and Social Integration

Historically, mathematics classrooms in the U.S. have had strong distinctions between on-task mathematical work and off-task socializing activities (Langer-Osuna, 2018; Langer-Osuna et al., 2018). However, drawing on prior research (Joseph et al., 2019), BlackFMP argues that this distinction between social talk and mathematical talk is inherently dehumanizing: "Who we are is fundamental to how we make sense of the world; when we must leave parts of ourselves at the door in order to be seen as 'acceptable,' we abandon

crucial sense-making resources" (Joseph, 2021, p. 89). Many Black girls, for example, must take on additional labor to overcome implicit and explicit messages that they are mathematically inferior when their ways of being are excluded by stereotypes of mathematicians as only serious and unemotional. When students are repeatedly disciplined for being social, loud, or goofy in the mathematics classroom, they experience mathematical violence (Martin et al., 2019) that reinforces stereotypes that they (e.g., Black girls) do not belong in mathematical spaces.

Making students feel unwelcome and incompetent alienates them in mathematics class and contributes to intellectual trauma and violence in mathematical spaces (Martin et al., 2019). Thus, curriculum design needs to attend to integrating academic and social ways of being into instruction. *Academic and social integration* necessitates support for teachers to be responsive to the particular students engaging with the written curriculum in each classroom. Curriculum materials that more fully integrate academic and social ways of being are structured to encourage students to bring their full selves to the mathematics classroom. For example, curriculum materials can support teachers in shifting their cultural assumptions about what mathematics learning should look like, explaining that laughter, exclamations, frustration, and, at times, a cacophony are to be both expected and valued.

Robust Mathematics Identities

Students' mathematics identities are their beliefs about themselves and how they can participate in the mathematics community (Aguirre et al., 2013). McGee (2015) conceptualizes *robust mathematics identities* as the strength and agency demonstrated by successful Black college STEM majors as they persist in their degrees despite experiencing racial stereotyping and discrimination. Building on McGee's work, Joseph (2021) expands this definition, which she calls "robust mathematics identities 2.0," to also include "resistance and critique of mathematics education systems that seek assimilation" (p. 90). Thus, when we refer to students with *robust mathematics identities*, we mean to describe students who are confident in their ability to understand mathematics deeply, who are persistent with challenging mathematics, and who are critically conscious about oppressive mechanisms in mathematics education and how they can resist them.

Mathematics curriculum materials can support the development of students' *robust mathematics identities* by challenging misguided and dominant discourses of who can do mathematics and providing opportunities for students to view themselves positively as mathematics learners and doers and as having the strength and agency to resist assimilation into oppressive mathematical spaces. Attending to this dimension requires providing many opportunities for students to see diverse representations of themselves and their communities within the materials, including both representation in characters and representation of mathematics. For example, in the U.S., frequently foregrounding examples of successful Black mathematicians in the curriculum, not as an anomaly, can support Black learners in reconciling their racialized understanding of their mathematical expertise as legitimate (Berry et al., 2014). More broadly, having representations of minoritized people in general (and women in particular) engaging meaningfully in mathematics in multiple capacities—such as in academia, at work, and at home—can invite marginalized students to view themselves as mathematical thinkers and doers regardless of whether or not they intend to pursue careers in science, technology, engineering, or mathematics.[2]

Mathematics curriculum materials can also support the development of students' *robust mathematics identities* by situating mathematics tasks in everyday and social justice-

focused mathematics activities that relate to students' communities (Leonard et al., 2010; Rubel, 2017) and by regularly exploring the non-Western origins of mathematics concepts (D'Ambrosio, 2001; Rosa & Orey, 2011). These design elements can support students in seeing themselves and their communities as important contributors to the broader mathematics community, though on their own, they are insufficient. For them to be sufficient, teachers must understand the social contexts, cultural backgrounds, and experiences of their students (Martin, 2007). By attending to this dimension of BlackFMP, curricular design can intentionally work to build *robust mathematical identities* rather than leaving the development of mathematical identities as an afterthought.

Critical Consciousness and Reclamation

Developing critical consciousness about mathematics education results from a nuanced understanding of the political nature of mathematics as a discipline and mathematics education as a system. The development of critical consciousness allows us to act against oppressive systems and to navigate the tensions and contradictions within them. BlackFMP calls for curriculum developers to create opportunities for students to develop and exercise critical conversations by making space for alternative, transgressive, and hybrid conversations within the mathematics classroom. *Alternative* conversations expand to topics not traditionally debated in mathematics classrooms (e.g., exploring students' misconceptions as valuable resources for learning). *Transgressive* conversations challenge systems and routines in mathematics education (e.g., questioning the validity of particular assessment forms). *Hybrid* conversations welcome students' multiple forms of knowledge (e.g., their everyday or out-of-school knowledge) as valid sensemaking resources in the mathematics classroom.

Beyond critical consciousness, BlackFMP also calls for an extension of academic and social integration that incorporates critical consciousness, which Joseph (2021) refers to as *reclamation*. This includes supporting students not only in being their full selves but in acting as agents of their own best interests, even when this pushes back against oppressive systems. In her writing, Joseph (2021) describes this as students having "conscious spirits."

Such conversations and activities support students in reading and writing the world with mathematics (Gutstein, 2006), meaning they help students use mathematics not only to understand oppression and reclaim mathematics in ways that affirm their personhood (i.e., read the world with mathematics), but also to use mathematics to challenge social inequities (i.e., write the world with mathematics). Alternative, transgressive, and hybrid conversations should be held in a way that nurtures solidarity between teachers and students. This requires skillful facilitation from the teacher, especially on conversations and activities that tackle complex social issues. In other words, such conversations must be co-constructed by students and teachers to support Black girls' reclamation of their agency and voice in mathematics classrooms. Curriculum designers and teachers are unlikely to spark conversations in ways that lead to the production of justice-focused ideas if they have not carefully examined their own positionality, including their own identities, experiences, and beliefs in relation to social issues and the culture of mathematics and mathematics education.

Methods of Analysis

To understand how mathematics curriculum materials do and do not support humanizing and just teaching for Black girls in particular, we analyzed lessons from a secondary mathematics curriculum using Joseph's (2021) BlackFMP framework. To support the use of a pedagogical framework in our curriculum analysis, we synthesized guiding questions by summarizing our understanding of each dimension individually, and then collectively revising and narrowing until we reached consensus. We wrote one guiding question for each dimension:

1. *Ambitious mathematics instruction*: How does the curriculum allow students to engage in argumentation, reasoning, modeling, and problem solving?
2. *Academic and social integration*: How does the curriculum allow humor and socializing to promote healing from intellectual trauma and violence in math spaces?
3. *Critical consciousness and reclamation*: How does the curriculum create opportunities for alternative, transgressive, hybrid spaces generated and occupied by students' conscious spirits?
4. *Robust mathematics identities*: How does the curriculum support students to view themselves positively as math learners and doers, as well as having strength, agency, and resistance to oppressive mathematical experiences?

We then developed a codebook based on the BlackFMP framework. To do so, we identified key ideas and terms in the BlackFMP framework and organized them in a taxonomy under the four dimensions of BlackFMP. We then began rounds of coding a focal curriculum, which led us to iteratively revise the codebook to reduce overlap across and within the four categories, refine the usefulness of codes and their descriptions, and to ensure the codes and our conversations centered on Black girls.

As an example of how the codebook was iterated, BlackFMP distinguishes between procedural fluency and conceptual understanding; to resolve coding disagreements, we needed a more nuanced approach to cognitive demand. So, we took up Stein et al.'s (2009) framework of high cognitive demand (i.e., *doing mathematics* and *procedures with connections*) and low cognitive demand (i.e., *procedures without connections* and *memorization*). The cognitive demand framework supports our analysis in our aim to discover how rich curricular tasks are rather than assuming their richness ("group-worthy tasks," Lotan, 2003) or looking at whether they spur rich interactions (e.g., sociocultural studies of learning; Engle & Conant, 2002; Sengupta-Irving & Enyedy, 2015).

After coding several lessons, discussing the results, resolving dilemmas, and modifying the codebook, we settled on sub-codes for each of the four guiding questions. We share the sub-codes in the form of heuristic questions (see Results section) to support a fuller understanding of each guiding question based on the BlackFMP framework (Joseph, 2021) and our attempts to use it to code curricula. Because we conjecture that this framework centering on Black girls will benefit all students, we use "students" in our code descriptions rather than "Black girls." Once the codebook stabilized, we recoded all prior lessons to ensure consistency. Thus, our process of iteratively building a codebook from both BlackFMP and the lesson analysis allowed us to transform the pedagogical framework of BlackFMP into a tool for analysis of a published mathematics curriculum.

The analysis we share here focuses on two lessons from our focal curriculum (see Focal Curriculum section below). Throughout our coding process, at least two coders reviewed each lesson to ensure triangulation of our findings (Flick, 2018). Disagreements were resolved, and consensus was made during weekly research team meetings. Team members worked asynchronously, using the heuristic questions to guide each of our understandings of what a redesign for the lessons could look like before working as a collective to redesign the lessons for alternative sequences, problems, and contexts that could more fully align with the four dimensions of BlackFMP. We identified areas of tension to highlight in this paper by coding an additional two lessons that immediately preceded our focal lessons. Eanes Snowden (Author 3) joined our research team after the lessons had been coded. Adding another team member further supported our efforts toward ensuring the findings were credible, dependable, and transferable (Lincoln and Guba, 1985) and helped to identify and refine representative examples of how the curriculum materials support each dimension of BlackFMP (Joseph, 2021) from the coded sections.

While neither new nor unique to BlackFMP, attention toward equity in mathematics education must build on the foundation of ambitious mathematics instruction. We acknowledge that attending to each dimension of BlackFMP in each task and perhaps in each lesson might yield an unmanageable curriculum. Curriculum writers must look at a curriculum as a whole and seek balance for competing demands. Rather than highlight how the two lessons do or do not attend to each dimension of BlackFMP, we attend to the most prominent dimension of BlackFMP within each lesson and its parts (e.g., student-facing tasks and teacher-facing implementation notes).

Educational Context

Our analysis is situated within the curricular context of the United States, where no national criteria for mathematics curricula exist. Instead, a set of guidelines referred to as the Common Core State Standards for Mathematics (CCSM; Common Core State Standards Initiative, 2010) were developed by a group of legislators (i.e., governors and curriculum leaders for each state) and made available for adoption by each state. The CCSSM includes specific content expectations for each grade level (e.g., students should be able to describe patterns in data and any striking deviations with reference to the data-gathering context), along with expected mathematical practices (e.g., the students should be able to form a mathematical argument). Since over 40 of the 50 states have officially adopted some version of the CCSSM, most mathematics curriculum materials in the United States are designed to address its recommendations.

Focal Curriculum

One set of materials designed to address the CCSSM for middle and high school (ages 12-18) is offered by CPM Educational Program (CPM), a non-profit organization that offers both curriculum materials and professional learning for teachers. CPM has demonstrated commitment to equity-oriented instructional practices since its inception in 1989, specifically through its three pillars of collaborative learning, problem-based learning, and mixed, spaced practice (CPM Research Department, 2022; CPM Research Department, 2024). Over the years, CPM specifically, and the mathematics education field broadly, has continued to develop nuanced understandings of the ways in which mathematics curricula can be better designed to support students from more diverse backgrounds. As such, CPM began developing the *Inspiring Connections* curriculum series for 6th- through 8th-grade mathematics (*Inspiring Connections Course 1*, *Inspiring Connections Course 2*, *Inspiring Connections Course 3*). Currently, this series is under various development and field-testing stages.

CPM supports *ambitious mathematics instruction* through instructional routines and group work teaching strategies that are embedded in each of the multi-modal Launch–Explore–Closure style lessons (CPM, 2022). For instance, the teacher notes in CPM materials prompt teachers to select and sequence examples of student work to highlight themes in students' understanding of mathematical ideas and promote mathematical discourse using the *5 Practices for Orchestrating Productive Mathematics Discussions* (Stein & Smith, 2011). Routines, such as the 5 Practices, are used to support teachers and students in focusing on mathematical thinking instead of classroom logistics (Kelemanik et al., 2016; Zwiers et al., 2017). Strategies for supporting students in working collaboratively in small groups are also threaded throughout CPM curriculum materials to support collaborative learning. To support collaboration and reduce implicit messaging about students' mathematical expertise and social standing in the classroom, teachers are encouraged to randomly assign students roles for work in small groups (i.e., Representative, Investigator, Coordinator, Organizer; see Cohen & Lotan, 2014) and form visibly random teams (Liljedahl, 2014). Strategies for supporting students' collaboration, such as inviting Investigators from each small group together for a short meeting to share new information or check for understanding before returning to their teams (i.e., a "huddle"), are suggested in the teacher materials for each lesson. Such strategies can assign additional competence to particularly marginalized students and shift power dynamics within small groups.

Researchers' Relationship to CPM

We selected CPM's *Inspiring Connections* series for both its design for *ambitious mathematics instruction* and our own proximity to the development of the curriculum. We share our positionalities in relation to our experiences as curriculum writers, researchers, and mathematics educators because these experiences directly impact our analytic processes. Because of our experiences as former educators and our current goal to challenge whiteness and heteronormative masculinity in mathematics education, our analysis centers Black girls as a way to uncover and foster Black brilliance in mathematics.

Jasien (Author 1) began supporting CPM's development through the organization's research arm in 2019, synthesizing research to inform the curriculum-writing process and engaging in critical evaluations of CPM deliverables to foster more equitable mathematical experiences for students in CPM classrooms across the country. Jasien identifies as a white, heterosexual, cisgender, able-bodied woman. She did not begin to recognize her privilege until her time as a high school math teacher in a community where her whiteness put her in a numerical minority and surrounding cultural norms made her own beliefs and white culture more visible to her. Working with the BlackFMP model has supported her in critically reflecting on the ways she enacted the status quo with her students and envisioning how a curriculum that embodied BlackFMP might have helped her disrupt rather than perpetuate problematic educational practices and outcomes.

Informed by his experiences partnering with Black and Latinx high school students in Newark, NJ, Lolkus (Author 2, a white, cisgender, heterosexual, able-bodied, man) joined the CPM curriculum writing team in 2022 to develop culturally relevant and social justice-focused mathematics curricula. Lolkus had become aware of his unearned privilege navigating life in a society normed by whiteness and heteronormative masculinity. He began to recognize the pervasiveness of his privilege through partnerships with students

and families as a high school mathematics teacher while pushing back against and learning more about practices that maintain white supremacy culture in mathematics classrooms. Utilizing BlackFMP supports his understanding of what can be centered in the immediate future when we actively work to decenter whiteness in secondary mathematics classrooms and work toward a more equitable and truly reimagined mathematics education.

Eanes Snowden (Author 3) joined this research team, and became familiar with CPM, through her appointment as the inaugural CPM Research Fellow. Eanes Snowden draws on her experiences as a Black woman and teacher of Black girls, and her BlackFMP expertise, to analyze and reimagine more humanizing and just iterations of *Mathematics Connections*. Her experiences being the only Black girl in her mathematics classes for the majority of her academic career led to developing a critical lens in understanding the ways that mathematics curricula and "traditional" ways of knowing are steeped in whiteness, and to a career path focused on Black brilliance in mathematics rather than the deficits that have been inherited from decades of disenfranchisement. Due to her experiences of being othered as a learner and as a teacher, this criticality informs her analysis and how she sees the dimensions of BlackFMP as a way to decenter whiteness in order to ensure that all students are welcomed in the math classroom.

Dietiker is a white, cisgender woman who currently holds roles as an Associate Professor of Mathematics Education and Associate Dean for Research at Boston University. Her research agenda centers on the interplay between curriculum design and teachers' and students' experiences in the mathematics classroom. Before becoming a professor, she was a high school mathematics teacher and department chair. She is also closely associated with CPM, being one of the organization's curriculum writers and a series editor. Until 2023, she was also on the leadership team and board of CPM, helping the non-profit to advance its goal to increase opportunities for all students to experience meaningful mathematics. Her experiences as a teacher, educational leader, curriculum expert, and researcher have led her to have a deep knowledge of and commitment to ambitious mathematics instruction. This work with BlackFMP has been a powerful way to expand her understanding of what it means to teach ambitiously and equitably for all students, particularly for Black girls.

Since Jasien and Lolkus are white scholars who create CPM curriculum materials that impact over 700,000 students in the U.S. and internationally each year, we have a responsibility to design asset-based curricula. Collectively, our commitment encourages us to question who is and can be served by our most recent efforts to develop mathematics curricula.

Focal Lessons

In this paper, we demonstrate CPM's curricular design approach by focusing on two lessons in its newest Grade 6 course: *Inspiring Connections Course 1*. These two lessons, entitled *The Job Offer* and *Weekly Earnings* (the third and fourth lessons in Chapter 6), present mathematics content as useful and something that makes sense. Both lessons provide students with experiences using data to inform financial decisions, including by prompting students to interpret data and write, simplify, and unpack expressions in contexts related to wage discrimination in the United States. By prompting students to compare their results across problems, lessons prompt students to make connections and draw meaningful conclusions about the relative value of an annual salary. The lessons

repeatedly ask students to justify their thinking and provide reasoning, as well as to consider implications for their own lives (e.g., through role-playing requesting a higher salary with a data-driven argument). Thus, these two lessons engage students in rich (Stein et al., 2009), high cognitive demand (Boston & Smith, 2009) tasks that are relevant to students' futures.

Results: (Re)designing to Center Marginalized Students

Because CPM in particular and many mathematics curricula in general in the U.S. are designed to align with *ambitious mathematics instruction* (which Joseph (2021) identifies as necessary but insufficient for equity), the redesigns we share focus on the less frequently attended to dimensions of BlackFMP: *academic and social integration*, *robust mathematics identities*, and *critical consciousness and reclamation*. The heuristic questions for each of these dimensions are provided in their corresponding sections below, and the heuristic questions for *ambitious mathematics instruction* are included in an Appendix. Here, we analyze a portion of the written curriculum (presented in Figures 2 through 6), with additional context (i.e., teacher notes) when appropriate.

The analysis is organized by the three focal dimensions from BlackFMP. For each of the three dimensions, we first focus on what we see the curriculum is already doing well according to the BlackFMP framework and then extend our analysis to find ways the curriculum has room for improvement. Interwoven with these areas for growth are broad-stroke suggestions for curricular redesigns that we speculate could increase opportunities for students and teachers to meaningfully experience the dimensions of BlackFMP. We see these suggested revisions as non-trivial edits to the curriculum that, though they would take substantial time and effort to implement, would add tremendous strength to the curriculum's likeliness to challenge intersectional biases and manifestations of oppression. These suggestions are not the only possible solutions for strengthening the curriculum based on BlackFMP but are examples that we find educational.[3]

Academic and Social Integration

Since Black girls experience trauma and violence in mathematical spaces, the BlackFMP framework guides us to recognize how mathematics curriculum materials can support students' *academic and social integration*, "by making the academic social and the social academic" (Joseph, 2021, p. 89). Focusing on *academic and social integration* supports our investigation of the ways in which mathematics curricula can promote healing from intellectual trauma and violence in mathematical spaces through attention to the minds and bodies of students. Table 1 provides the heuristic questions that guided our curriculum analysis.

For instance, as students enter the classroom for *The Job Offer* lesson, teachers greet them by asking the "Door Question" of, *What do you consider a good quality for a friend to have?* Teachers are prompted to ask similar questions each day. These Door Questions are not connected to the mathematical learning targets for each lesson, but rather to students' preferences and opinions. Asking questions about students' lived experiences and perspectives outside the mathematics classroom contributes to *academic and social integration* by supporting teachers and students in developing meaningful relationships and inviting students' personalities into the classroom. Practices for learning about students' communities and interests beyond their mathematical expertise, like Door Questions and handshakes, are still novel to many teachers (e.g., WCNC, 2017), but are common humanizing practices to others and assist in curating a learning environment of connectedness (Bartell, 2011).

Table 1 – Heuristic questions for curriculum analysis rooted in BlackFMP's dimension of *academic and social integration*.

Dimensions	Questions for Analysis	Heuristic Design Questions
Humanizing	In what ways does the curriculum encourage authoritarianism and compliance?	What resources can the curriculum provide for teachers to 1) see their students as people with natural and cultural needs, and 2) support students to be social and playful? Where are opportunities for the curriculum to challenge the status quo of participation normed by whiteness, such as by foregrounding students' physical and emotional well-being? How can the curriculum support shifts in participation norms in ways that affirm students' full selves?
Responsiveness	In what ways does the curriculum support teachers' goals rather than each student's goals and experiences?	How can the curriculum provide opportunities for teachers to elicit students' personal experiences as reflected in their communities and cultures? How can the curriculum support teachers in valuing the cultural and linguistic diversity of their students as a resource for learning? What additional supports would allow teachers to learn about and center students' goals and purposes for learning mathematics?

Then, as students begin *The Job Offer* lesson, they complete a lesson Launch activity focused on a quotation from a scholar who studied what constitutes good listening, Ralph G. Nichols (see Figure 2). This quotation prompts students to reflect on the importance of being understood and understanding others. Beginning the lesson in this way supports students' emotional well-being before engaging in what could be challenging conversations about wage discrimination. Centering students' socio-emotional well-being encourages educators to be responsive to the students in their classrooms by inviting each student's personality in its fullest, blurring imagined boundaries between students' academic and social selves.

Figure 2 – Launch from *The Job Offer* (Lesson 6.1.3) of Grade 6 CPM *Mathematics Connections* series (in preparation).

Read the following quote. Write down three words that come to mind when you read this quote.

> *The most basic of all human needs is the need to understand and be understood. The best way to understand people is to listen to them. —Ralph G. Nichols*

The CPM materials further attend to *academic and social integration* by eliciting students' personal experiences and working toward disrupting the status quo of participation in the workforce. After students complete the Launch and before the lesson's main character, Emily, is introduced (in problem 6-20, the first problem of *The Job Offer* following the lesson's Launch activity), the teacher notes encourage the teacher to consider potential stereotypes about women in the workforce (see Figure 3). These teacher notes again serve to support students' socio-emotional well-being by prompting the teacher to actively listen to students' ideas and justifications, while also challenging negative stereotypes about women. Prompting teachers to ensure students are heard—in this case, by not dismissing their thoughts or feelings—supports a sense of belongingness. Furthermore, requiring that students support statements with evidence can ensure that students who are marginalized, or who must manage additional emotional labor, are not exposed to as many hurtful comments.

Figure 3 – Introductory Teacher Notes from *The Job Offer* (Lesson 6.1.3) of Grade 6 CPM *Inspiring Connections* series (in preparation).

> If a student makes a comment during the discussion that upsets others, ask the student to base their claim in evidence. For example, if a student uses the bar graph in problem 6-22 to claim that women do not work as hard as men, ask the student, *What data led you to make that claim?* Students' perceptions are their realities, so do not dismiss their thoughts or feelings. Make sure they feel heard while guiding them to ground their statements in evidence. Keep these lists of expectations visible throughout Lesson 6.1.2 and Lesson 6.1.3. While these lists might always be appropriate, they will be especially useful in these lessons as students discuss difficult topics, such as income inequality.

Throughout *The Job Offer* and *Weekly Earnings* lessons, students have multiple opportunities to be social when teachers use the embedded instructional routines and group work teaching strategies. In these lessons, students work in teams of four or in breakouts with partners. In each Launch, for instance, students have opportunities to be social by discussing mathematical concepts with their neighbors following a "Think-Ink-Pair-Share" and "Talk-Write-Discuss" sequence, respectively. Beyond encouraging students to work collaboratively, as in the Launches, strategies such as a Dyad[4] are outlined in problems 6-21 and 6-31 to "ensure each student thinks about the fairness of the offer, has time to formulate their thoughts, has a chance to speak, and listens to someone else's perspective" (problem 6-21 teacher notes). Thus, students are encouraged to be social while developing their mathematical understanding and to practice demonstrating respect for one another while doing mathematics.

We further recognize opportunities for teachers to promote understanding through socializing prior to engaging with mathematics through prompts for teachers to use the Three Reads mathematical language routine (Zwiers et al., 2017) in problem 6-21 and the Teammates Consult[5] strategy in problem 6-22. Both strategies require students to discuss the context of mathematics questions prior to solving them. These strategies promote mathematical sensemaking by bridging students' academic and social experiences. Finally, students are encouraged to be playful with what is often a serious topic through rounds of role-playing salary negotiations with multiple partners in the *The Job Offer* lesson's Closure.

Further opportunities to attend to academic and social integration

While the CPM materials already do important work to support *academic and social integration*, this dimension of Joseph's (2021) BlackFMP encourages us to consider how *The Job Offer* and *Weekly Earnings* can be further humanizing. Students have opportunities to use their mathematical knowledge for liberation (e.g., *The Job Offer*'s lesson Closure activity), and yet there are no resources for teachers to connect to their students' natural and cultural needs, nor to encourage participation in the classroom in ways that challenge the U.S.'s dominant white norms and ideals. For example, the curriculum prompts students to rely on mathematics, not their emotions, when role-playing how Emily might negotiate her salary. This devalues students' anger and frustration with systemic injustices and discrimination. As such, students—especially those who have been marginalized in mathematics classrooms and must take on additional labor to control and restrain their emotions (Battey & Leyva, 2016; Matias, 2014)—could have more opportunities to bring their full selves into the classroom through integrating socializing into mathematics learning if their emotions were welcomed as a resource for sensemaking rather than rejected as irrelevant.

There are numerous pedagogical practices that can support students to bring their full selves into the mathematics classroom. For example, encouraging humor and playfulness can invite students to participate in new ways (Joseph et al., 2019) and can counter persistent stereotypes of Black girls as disruptive (Francis, 2012). Still, we recognize the tension between the recommendation for teachers to incorporate playfulness and goofiness in mathematics lessons with the seriousness of wage discrimination. This tension is further complicated by the recommendation that we call on curriculum designers to provide opportunities to unpack the intersectional nature of wage discrimination to support students who, if historical trends continue, will likely face discrimination due to the minoritized dimensions of their identities. In the Launch of this particular lesson (see Figure 2), teachers may strengthen their relationships with students and the class' sense of familiality by joking about a personal infatuation or a student's interests. Such lightheartedness in the Launch can foster a sense of community prior to engaging with the heavy topics that could come up in a task designed around data that reflects income inequality. Balancing goofiness and seriousness provides opportunities for students, and their teachers, to disrupt stereotypes through attention to systems of oppression alongside critical reflection (Joseph, 2021).

Finally, while students have ample opportunities to engage in collaborative sensemaking of mathematics through teamwork, there are no explicit references to what languages are valued in the learning space. In the U.S. context, Black learners have been required to "code-switch" in mathematics, and other content areas, by separating the language they use in their communities from the language they learn in formal academic spaces (cf. McGee & Martin, 2011). Future iterations of these lessons could encourage teachers and students to utilize their full language repertoire, dynamically moving between and merging their multiple languages (e.g., AAVE, Spanish, Standard American English). This could be accomplished, for instance, by encouraging students to use all their languages and dialects in their verbal and written responses, displaying student work samples that include languages and dialects that are often excluded from classroom spaces, and centering examples of multilingual student discourse in the student-facing materials. Encouraging and embracing students' multiple languages can further support students in bringing their full selves to the mathematics classroom.

Robust Mathematics Identities

Because mathematics has been constructed as an exclusionary institutional space, many Black girls have not been socialized to see themselves as doers of mathematics, making the development of positive mathematics identities challenging (Joseph et al., 2019). BlackFMP guides us in supporting students' *robust mathematics identities* by challenging dominant narratives of who does mathematics and providing opportunities for students to be represented within the curriculum materials. Table 2 provides the heuristic questions that guided our curriculum analysis.

Table 2 – Heuristic questions for curriculum analysis rooted in BlackFMP's dimension of *robust mathematics identities*.

Dimensions	Questions for Analysis	Heuristic Design Questions
Representation in characters	In what ways does the curriculum center white or other dominant groups in the characters it presents and develops?	What are opportunities within the curriculum to diversify the representation of who does mathematics? How can the curriculum regularly include marginalized students in powerful roles?
Representation of mathematics	What kinds of mathematics and whose mathematical history is privileged within the textbook?	What curricular features could diversify the mathematical experiences presented to students, such as everyday mathematics (e.g., in baking, grocery shopping, non-numerical mathematical investigations, etc.)? What opportunities could be included to connect mathematics to real-world applications? Where can hypothetical data be replaced by publicly available data from the real world? How can the curriculum incorporate meaningful explorations of the mathematics of non-Western and BIPOC communities?
Expansive definition of achievement	Does the curriculum reinscribe traditional notions of achievement such as quickness, correct answers, and high grades?	How can the curriculum provide explicit support for students and teachers to view achievement as challenging oneself mathematically?
Disrupting dominant narratives	In what ways does the curriculum perpetuate misguided, exclusionary interpretations of who is mathematical and who has the necessary experiences for developing a mathematical identity?	What tools and resources can the curriculum provide for students and teachers to revise their interpretations of what a mathematics identity is and develop a more expansive and inclusive notion of mathematics identity?

We use much of *The Job Offer* lesson, including problems 6-20 through 6-23 (see Figure 4) and the lesson's Closure activity (see Figure 5), to analyze how the CPM materials might support students' *robust mathematics identities*. This sequence culminates with a prompt for students to practice advocating for a fair salary given what they learned about wages for people from various educational backgrounds and years of experience with the company. Through role-playing how to use data to advocate for themselves in the workplace, students have opportunities to use mathematics as a tool to challenge the status quo, disrupt cycles of oppression, and have their perspectives and ideas validated and refined as they work to advocate for themselves with mathematical justifications. We argue that the design supports students in seeing how mathematics could be used within their own community. Moreover, we view this as an opportunity for students to envision their future selves as capable and competent prospective employees who deserve competitive wages.

Figure 4 – Core Problems from *The Job Offer* (Lesson 6.1.3) of Grade 6 CPM *Inspiring Connections* series (in preparation).

Highest educational attainment	Median annual starting salary ($)
Doctoral degree	90,636
Professional degree	95,472
Master's degree	72,852
Bachelor's degree	60,996
Associate degree	43,472
Some college, no degree	40,248
High school diploma	37,024
Less than a high school diploma	27,040
Source: U.S. Bureau of Labor and Statistics	

6-20. Emily is a recent high school graduate. She is looking for a job and wants to know what starting salary she should expect. She does some investigating and sees the table shown.

a. What do you notice?
b. What do you wonder?
c. What do these data suggest to you?

STATS AND HEALTH INC

Camila Rodriguez
Stats and Health Inc.
31415 Pie Court
Cherry Hill. MT 59721
406.926.5358

July 10, 2021
Emily Miller
2718 E Street
Golden. CA 90452
916.281.8284

Dear Emily Miller,

I am pleased to offer you full-time employment at Stats and Health Inc. A detailed job description is attached to this letter for your reference. This position will begin on Monday, July 23, 2021. The hours of work are 7:00 a.m. to 4:00 p.m. Monday through Friday, with a one-hour lunch break each day, for a total of 40 hours per week. Pay will be at a rate of $10.75 per hour.

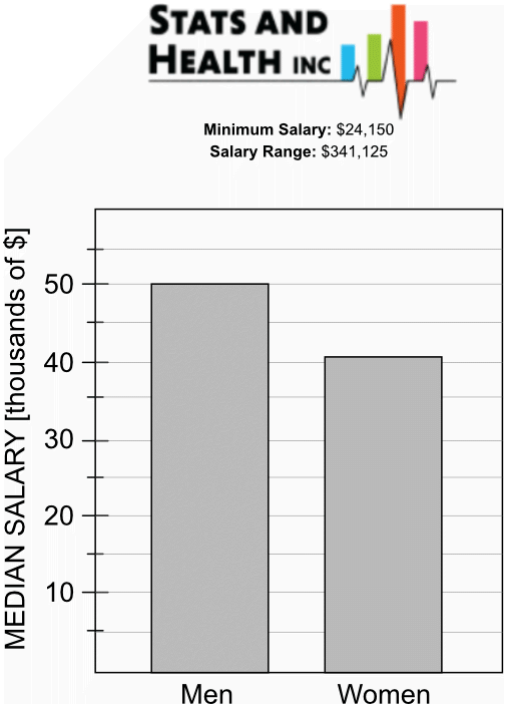
If you accept this offer of employment, please sign and return the attached contract.

I look forward to working with you

Sincerely,
Camila Rodriquez
President, Stats and Health Inc.

6-21. Emily gets a job offer at Stats & Health Inc. Her job offer is shown in the letter.

a. What would Emily's annual salary be if she accepts this position? Assume that she works 50 weeks a year.
b. How does the salary you calculated in part (a) compare with the salaries listed in the table in problem 6-20?
c. Do you think this offer is fair? Why or why not? If not, what do you think is a fair offer?



6-22. Emily wants to make sure the job offer is fair, so she decides to keep investigating.

First, she talks with some of her older friends who already work at Stats & Health Inc. None of her friends have worked for the company for more than two years. She asks them what their salaries are and writes them in a list.

$25,600, $26,500, $28,750, $29,100, $29,950, $30,075, $35,250, $36,300, $37,050, $38,275

Next, Emily does an Internet search for information about salaries at Stats & Health Inc. and she finds the following infographic.

a. Calculate the mean and median of Emily's friends' salaries.
b. What does "salary range" mean?
c. What is the maximum salary at Stats & Health Inc.?
d. d. What information does the bar graph provide?

6-23. Emily needs your advice about the job offer.

1. Should she accept the job offer? Why or why not? Use the information in problem 6-14 to support your answer.
2. Suppose Emily decides to negotiate for a higher salary. What salary do you think she should ask for? Provide at least two data points to justify this salary.

Figure 5 – *The Job Offer* (Lesson 6.1.3) Closure and Teacher Notes of Grade 6 CPM *Inspiring Connections* series (in preparation).

Closure

Use your response from part (b) of problem 6-23 to practice asking for a higher salary. Role play with a partner. One person pretends to be Emily and the other person pretends to be the employer. Then swap roles. Go back and forth until you feel comfortable using data to advocate for yourself.

Teacher Notes

{ Students role play with a Proximity Partner. }

Each student needs to decide on a salary and the appropriate data to use to justify that salary; they do not need to choose the same salary as their teammates. Then use **Proximity Partners** for students to find a partner.

Students will role play as Emily and the employer, each taking turns with each role. Once students have practiced with one partner, they move around the room until they find another partner. The goal is for students to feel empowered. They may need to role play several times until they feel comfortable asking for a fair salary. The focus should be on using the data to justify the higher salary and not relying on emotions.

Further opportunities to attend to robust mathematics identities

Throughout Lessons 6.1.3 and 6.1.4, there are opportunities for the CPM curriculum materials to further support students' development of *robust mathematics identities*. While students have opportunities to unpack gender and racial stereotypes and pay discrimination, the materials should further support more students to see themselves represented in the written curriculum, perhaps by increasing the diversity of characters in the textbook. For example, Emily is introduced in *The Job Offer* (i.e., problem 6-20 through Closure) but does not make an appearance anywhere else in the textbook. New characters are introduced throughout the *Weekly Earnings* lesson (i.e., Laila, Zackery, Bailey). Each of the characters in this sequence utilizes names that are most common in predominantly white spaces: approximately 78% of people named Emily in the United States are white; similarly for Zackery (76%), Bailey (75%), and Laila (62%; MyNameStats, 2023). While the problems encourage students to investigate the compounding levels of wage discrimination based on gender and race or ethnicity (i.e., problem 6-33), the character names are not inclusive.

Each character introduction provides an opportunity for the written curriculum to represent BIPOC characters with rich and intersectional identities. Thus, one area of growth to support BIPOC students in seeing themselves represented in mathematics lessons could be including names that are frequently used in Black communities (e.g., Aliyah, Imani, Nevaeh). Foregrounding traditionally non-white names provides teachers and students with a greater opportunity to challenge their default assumption of a student from a dominant group. In general, students from dominant groups (e.g., in the U.S., white, able-bodied, middle-class, heterosexual, cisgender males) frequently see people who look like them in positions of power, while students from non-dominant groups rarely see themselves represented as decision-makers in positions of power, or in textbooks as competent STEM characters (Piatek-Jimenez et al., 2014).

While this alteration to the curriculum materials could be done quickly, it is important to critically consider how students, especially those who have been historically excluded from mathematical spaces, are represented. For instance, simply or randomly including the names of BIPOC students may reinforce stereotypes or result in tokenism (Aikenhead, 2017; Hodson & Dennick, 1994). Here, Emily is not positioned as someone who feels competent making mathematical decisions herself, so we also wonder about the impact of replacing the predominantly white name of Emily with a more common name for Black girls in the U.S., like Nevaeh. At the same time, Emily is acting as a competent mathematician by seeking out data that can help answer her important life question by using mathematics. To address these tensions, curriculum designers must normalize the consistent inclusion of racially diverse characters and develop them meaningfully within individual problems, lessons, and across the entire written curriculum.

By further attending to students' strength, agency, and resistance, the CPM materials could prompt students to reflect on how the mathematical inferences they made during the lesson can help them develop ways to advocate for a fair salary, thus supporting students in recognizing the ways mathematics can benefit them personally. Even more, the CPM materials may make assumptions about students' interests and motivations for excelling in mathematics. Centering issues of pay discrimination is likely motivating for many students; however, in the current design, students do not have opportunities to insert their own interests or motivations into the task beyond determining whether Emily's salary is fair (i.e., problem 6-21) and advocating for a higher salary (i.e., *The Job Offer*'s lesson Closure activity). Inviting students' identities into the curriculum materials could be

accomplished, for instance, by prompting students to share their own career aspirations or understandings of discrimination in the workforce. Beyond focusing on finances and competition, lessons can and should attend to mathematics in culture (i.e., ethnomathematics; D'Ambrosio, 1985), nature, abstract patterns, and additional topics elicited from students.

Critical Consciousness and Reclamation

In addition to being socialized to see themselves as incapable of mastering mathematics, Black girls are commonly labeled as disruptive and less attentive (Fordham, 1993; Hines & Wilmot, 2018), thus denying them the opportunity to bring their full selves into the mathematics classroom (Joseph et al., 2019). *Critical consciousness and reclamation* makes space for transgressive conversations within the classroom, which creates openings for Black girls to push back on oppressive systems while bringing their full selves into mathematics. The BlackFMP (Joseph, 2021) framework helps us to see a productive attempt at creating opportunities for teachers to support students in having transgressive conversations. Table 3 provides the heuristic questions that guided our curriculum analysis.

Table 3. Heuristic questions for curriculum analysis rooted in BlackFMP's dimension of *critical consciousness and reclamation*.

Dimensions	Questions for Analysis	Heuristic Design Questions
Read the world with mathematics	How does the curriculum privilege decontextualized investigations of mathematics?	How can the curriculum position students to consider mathematics as a tool to benefit others and society? Where are opportunities for the curriculum to reference how mathematics has been and is used as a tool for oppression? How might the curriculum support students' inquiry into the purpose of mathematics in students' lives and in the world from students' perspectives?
Write the world with mathematics	How does the curriculum omit opportunities for students to advocate for themselves, their peers, their communities, the global community, and the planet?	How can the curriculum explicitly articulate that mathematics is a tool that can be used to dismantle inequities in and outside of school? How can the curriculum support students in reclaiming mathematics ideas and spaces in ways that affirm their personhood?
Solidarity between students and teachers	In what ways does the curriculum create and maintain hierarchies of power between students and teachers?	How can the curriculum enable students and teachers to work together with distributed authority? What additional professional learning opportunities might teachers need to skillfully facilitate conversations on complex social issues?
Author positionality	How do the identities, experiences, and beliefs of the curriculum authors reflect the dominant class?	Where can the curriculum authors describe how their own identities, experiences, and beliefs shape their curriculum writing, highlighting both strengths and limitations?
Teacher positionality	In what ways does the curriculum encourage teachers to assimilate students into their worldview?	How can the curriculum provide opportunities for teachers to reflect on how their own identities, experiences, and beliefs both strengthen and limit their ability to teach equitably?

Figure 6 – Culminating task from *Weekly Earnings* (Lesson 6.1.4) of Grade 6 CPM *Inspiring Connections* series (in preparation)

6-33. Bailey finds data from the U.S. Bureau of Labor Statistics. The table shows the median weekly earnings for different groups of people in April 2020.

Sex, Race, and Hispanic or Latino Ethnicity	Median weekly earnings ($)
White	979
Men	1,096
Women	873
Black or African American	775
Men	823
Women	742
Asian	1,221
Men	1,360
Women	1,106
Hispanic or Latino ethnicity	722
Men	763
Women	678
source: U.S. Bureau of Labor and Statistics	

Bailey writes the three expressions shown in parts (a) through (c). For each expression, complete the following:

i. What question might Bailey be answering by writing this expression?
ii. Justify your answer by explaining what each term in the expression means.
iii. Perform the calculation to answer the question you wrote in the first bullet.

a. 52(678 + 678)
b. 5 x 52 x (1,096 + 823)
c. (1,360 + 1,106) - (763 + 678)

Teacher Reflection Question

How might you respond to students who have an emotional reaction to the data in this problem?

Teacher Notes

Move teams to problem 6-33. The expressions in this problem require using the Order of Operations to evaluate. Students need to complete the addition within the parentheses before completing the other operations. Students have been evaluating expressions like this since 3rd grade (3.OA.B.5), so this problem should serve as a reminder. However, continue to monitor their work as you circulate and provide support as needed.

The context of problem 6-33 (median weekly earnings for men and women of different races and ethnicities) lends itself to a conversation about income inequality. After teams complete this problem, lead a class discussion. Start by reminding students of the class's agreed-upon expectations for respect and collaboration. Then ask the class questions, such as:

- What do you notice? What do you wonder? Was anything surprising to you? What questions do you have?
- Why were these data collected? Where did they come from?
- Who is affected by these data? Who could be hurt by them? Who could be misled by them?
- What are the benefits and challenges of living in a diverse society?

These data highlight issues of income inequality in the U.S. based on sex, race, and ethnicity. The data highlighted in this problem could cause some people to create confirmations of racism or sexism. For example, they might argue that Black people should make less money because they do not work as hard. This racist argument is unacceptable. Instead, the data and the subsequent discussion should be used to challenge the system that has created the inequities. Consider collaborating with your colleagues in the Social Studies or History departments to continue the discussion beyond this lesson.

If you do not feel a class discussion would be appropriate or productive for your class, conduct another Dyad instead so that students can express their thoughts about the data. Students will likely start asking about up-to-date information about income. Move them to 6-34 which gives them an opportunity to research this information.

We selected the student and teacher edition of the *Weekly Earnings* lesson's problem 6-33 (see Figure 6) to illustrate how the CPM materials attend to *critical consciousness and reclamation* because the teacher edition explicitly calls attention to problematic ideas that may arise and directs teachers to challenge those ideas.

In the *Weekly Earnings* lesson, students encounter a table of data from the U.S. Bureau of Labor and Statistics (2018) that includes information on median weekly earnings for men and women of various races/ethnicities including white, Black or African American, Asian, and Hispanic or Latino. When students encounter this table, they have the opportunity to notice that across all racial/ethnic categories, women make less than men (gender discrimination); that Black/African American and Hispanic/Latino people make the least overall (racial discrimination); and that Black and Hispanic women are doubly discriminated against in their wages. While the student-facing text that accompanies the table does not explicitly ask students to notice and wonder about wage differences by gender and race together, it does do tacit work to illustrate discrimination.[6]

In the teacher-facing instructions for problem 6-33 (see Figure 6), teachers encounter prompts they can use to encourage students to probe the data from the U.S. Bureau of Labor and Statistics (2018). For example, the text suggests that teachers ask students about why the data was collected and where they came from, which may support students in discussing the importance of the census for getting an accurate perception of the state of equity and equality within the United States. It also asks students to consider who could be affected, hurt, and misled by the data in the table. While the data in the table represents how wage discrimination affects people of different races/ethnicities and genders, the table itself does not affect anyone directly, and we see that these questions are likely to support a conversation about the role of biases in creating wage discrimination. For example, by asking how people could be misled by this data, the teacher notes support a conversation exposing and challenging misled classist and racist ideas that link work ethic to wages, positioning women and the majority of racial/ethnic minorities as lazy or incompetent and therefore undeserving. In order to continue the conversation, the text encourages teachers to collaborate with their school's Social Studies or History departments. With this support, teachers can be prepared to exercise solidarity with students as they facilitate a discussion about how using the data to affirm racist and sexist ideas is unacceptable.

Further opportunities to attend to critical consciousness and reclamation

While we argue that the materials productively support students in reading the world with mathematics, BlackFMP allows us to imagine ways to further students' opportunities to develop critical consciousness and reclamation in mathematics classrooms. For example, since the questions in the student text do not explicitly prompt students to notice or explore wage-based racial and gender discrimination, it is possible for these issues of power to remain unexamined in the public space of classroom discussion. Although we were heartened to see opportunities for meaningful dialogue, the social issues of racism and sexism are only explicitly mentioned in the teacher-facing notes as a caution. We argue that the teacher edition for this problem could be strengthened by suggesting that teachers actively learn more about the lives of their students and build solidarity with students. This is a critical feature, as most teachers of marginalized students, particularly in the United States, do not share the experiences of marginalization that their students experience. Namely, as students in U.S. classrooms increasingly represent more racially diverse communities, teacher demographics continue to predominantly reflect those of white women (Albert Shanker Institute, 2015; Goldenberg, 2014; Landsman & Lewis, 2006).

Furthermore, there are many issues that might emerge that were not mentioned in the teacher edition. For example, the lesson uses data from the U.S. Bureau of Labor and Statistics (2018), which assumes a gender binary of male/female. Neither the student edition nor the teacher edition problematizes the limits of this binary, nor addresses heterosexism, which the problem affords for examination. We also note that although students would likely have much to discuss regarding fairness of pay based on the student edition task, common reactionary discursive patterns such as white fragility (DiAngelo, 2011) and mansplaining (Joyce et al., 2021) could easily emerge. Yet, the teacher notes do not explicitly prepare teachers to deal with these discursive mechanisms of oppression. Moreover, some students might become singled out during a discussion or be positioned to defend a human right (as opposed to a mathematical claim) based on their racialized and gendered identities. Such tokenizing occurrences, without intervention (and perhaps initiated) by the teacher, would likely damage students' relationships with each other and further contribute to negative and marginalizing experiences in mathematics classrooms.

We note that curriculum materials cannot prepare teachers for everything, and thus a robust professional development program may be needed to accompany written mathematics curricula that address such social issues. Although outside the scope of this analysis, CPM has one such professional development program. We recognize that, like the curriculum materials, it likely has room to grow.

We imagine that supporting both curriculum designers and teachers in ongoing reflection on their own identities, experiences, and beliefs around gender and race discrimination (e.g., in wages) would better enable the alternative, transgressive, hybrid conversations that BlackFMP argues are required in equitable mathematics teaching and learning. We argue this with the caveat that, again, curricula alone are unlikely to support teachers in meaningfully reflecting on these complex social issues and their place within them and so should be supplemented with carefully designed professional learning experiences.

Converging Dimensions of BlackFMP

Although we think it is uncommon to find a task in which all four dimensions of BlackFMP can be strongly leveraged to strengthen the task, we selected problem 6-33 of *Weekly Earnings* (see Figure 6) to illustrate how *ambitious mathematics instruction*, *academic and social integration*, *robust mathematics identities*, and *critical consciousness and reclamation* can come together in one problem by attending to wage equity and also including fodder for students to investigate issues of intersectional oppression on the basis of gendered and racialized identities, as noted in the Critical Consciousness and Reclamation section. Joseph's (2021) BlackFMP framework helps us to see a productive attempt within the curriculum materials to challenge intersectional oppression as it manifests through identity, and also to see ways to strengthen what is already there.

Specifically, this problem prompts students to brainstorm what the focal character, Bailey, might be wondering about when she wrote the expression 52(678 + 678). Because 678 is the median weekly earnings for Hispanic/Latino women in the table from the U.S. Census Bureau, this may lead students to think about households where two Hispanic women are the breadwinners, such as a mother and a grandmother, or two mothers. Supporting students in encountering such situations where women are the breadwinners could reduce biases in favor of men as heads of household, and encountering situations with same-

gender couples could help reduce heterosexism as multiple sexualities become normalized. Foregrounding Hispanic women for this problem may also provide an opportunity for students to consider the compounding economic disadvantage that results in Hispanic lesbians and Hispanic female-headed households experiencing the highest degree of wage discrimination.

Problem 6-33 also asks students to consider what Bailey may have been wondering about with the expression (1,360 + 1,106) – (763 + 678). The numbers in these expressions tell us that Bailey is looking at the weekly income difference for heterosexual families with the highest income (Asian) and lowest income (Hispanic), thus tacitly supporting students in thinking more explicitly about racial differences in wage discrimination. While these examples come from the student-facing text, the teacher-facing notes expand on these ideas, suggesting that teachers ask students what they notice and wonder about within the problem, as well as explicitly supporting teachers in pushing back if students express classist and racist ideas about particular groups, such as the harmful model-minority Asian stereotype in the U.S. (Kao, 1995; Lee, 1994, 2015). The teacher notes provide guidance for facilitating class discussions about challenging topics, such as racism and sexism, as well as potential stereotypes that may be shared. These potential pitfalls of the discussion are shared to ensure teachers support and protect their students' emotional well-being by limiting particularly marginalized students' exposure to dehumanizing narratives in the mathematics classroom (i.e., *academic and social integration*).

Each of the problems in *The Job Offer* and *Weekly Earnings* is situated in everyday mathematics with real-world applications, providing students with opportunities to perceive mathematics as sensible, useful, and worthwhile (i.e., *robust mathematics identities*). In problem 6-33, in particular, students recognize how they can rely on their mathematical competence to better understand discriminatory practices on the bases of workers' gendered and racialized identities. Through their mathematical understandings, students are prepared to advocate for and see themselves as worthy of receiving equal pay for equal work. Although the problem centers procedures, they are utilized to reinforce conceptual ideas around how to write and solve numerical expressions that require reasoning and sensemaking (i.e., *ambitious mathematics instruction*). This high cognitive demand focus of problem 6-33 is further underscored in the teacher notes, where teachers are provided with guiding questions to support students' understanding of the problem context.

Further opportunities to attend to converging dimensions of BlackFMP

While attending to all four dimensions can be unwieldy, in this example, there are opportunities to further connect to BlackFMP. Acknowledging that problem 6-33 already does important work to create opportunities for students to consider how the intersection of varying dimensions of identities can shape individuals' encounters with privilege and oppression, we can, with the support of BlackFMP (Joseph, 2021), imagine ways the curriculum materials could go further.

One way *Weekly Earnings* might attend to issues of *intersectionality* is by giving Bailey's character a backstory to allow readers to connect with or learn from her (i.e., the concept of windows-and-mirrors; *robust mathematics identities*). In other words, rather than having Bailey as a temporary character, this problem could do more work to support students in interrogating issues of intersectionality if Bailey had a backstory that enabled students to understand why Bailey might care about the expressions she is writing and the questions they represent. With the current design, students have no way to know why Bailey cares about the questions the expressions might represent, or why they should care

about them. Why does Bailey care about the median five-year household earnings for a white man and a Black man? In a redesign, Bailey could make connections to her own identity or to her family to make a counterstory to dominant narratives more explicit (i.e., *academic and social integration*). Perhaps Bailey wants to know about the yearly earnings for a Hispanic lesbian couple because she wants to imagine what her mothers' combined income is or what her household income might be when she grows up. The curriculum materials might give us insight into some character development for Bailey, with readers coming to learn about how hard-working Bailey's mothers are, thus challenging racist and sexist stereotypes about wages being reflective of work ethic.

Additionally, it is critical to ensure curricular resources challenge and work to upend, rather than reinforce, stereotypes that harm marginalized populations (i.e., *critical consciousness and reclamation*). For instance, while engaging in conversations about wage discrimination by racialized and gendered identity groups provides an opportunity to use mathematics to uncover intersectional forms of oppression, there is also reason to acknowledge and cease gap-gazing practices (see Gutiérrez, 2008; Lubienski, 2008; Lubienski & Gutiérrez, 2008), as these cement narratives and unnecessary hierarchies of power, status, and opportunity in the global society and recreate them within mathematical spaces.

Our analysis of *The Job Offer* (problems 6-21 through 6-23; see Figure 4) also reveals some room for improvement. There is an endemic challenge to designing mathematics lessons that foster students' engagement with social issues (i.e., *critical consciousness and reclamation*): too often, either the math or the social issue is foregrounded instead of the two being meaningfully interwoven, due to constraints such as time (Gregson, 2013), the instructor's sociopolitical or mathematical knowledge (Kokka, 2015), or even challenges to aligning mathematical and sociopolitical goals (Brantlinger, 2011). We found that the scaffolds that we interpret as the curriculum designers' attempts to avoid de-elevating the mathematics actually reduced the cognitive demand across the questions (e.g., many of the tasks in the lesson begin with lower cognitive demand and build to more conceptually focused problems; *ambitious mathematics instruction*).

Consider if problem 6-21 was redesigned to only contain parts (b) and (c) so that students were simply asked whether the salary offer was fair given the salaries listed in problem 6-20. Students would need to recognize that the rates of pay in the offer letter could not (in their present form) be compared with the given annual salaries, and thus the calculation currently prompted in part (a) of problem 6-20 would be undertaken with meaning and without prompting. Such a redesign would leave room open for some groups to compare salaries by converting the annual salaries into equivalent hourly wage rates, providing the teacher an opportunity to emphasize that problems have multiple solution paths. Both solution paths would require students to recognize the need for additional information; namely, how many weeks it is reasonable to assume Emily would work for a starting position. For those students who calculate the annual salary, this redesign would also shift its purpose: rather than the calculation of annual salary being an end goal without any indication of where the overall problem is headed, this calculation would instead be undertaken purposefully for the ability to make an important life decision (*academic and social integration*).

Discussion

We selected a framework that enabled us to reimagine a mathematics curriculum in ways that better support students who have been historically marginalized in mathematics classrooms. Around the world, students experience marginalization on the basis of their gender, religious beliefs, and ability status, among many other dimensions. In the U.S., Black girls experience marginalization through intersecting forms of oppression focused on their racialized and gendered identities. Joseph's (2021) BlackFMP framework supported our sensemaking about both *ambitious mathematics instruction* and opportunities for students to engage in more marginalized yet essential dimensions of mathematics learning in the CPM curriculum materials.

Taking a BlackFMP lens allowed us to expand our curriculum design work by identifying both ways the materials were likely to support particularly marginalized students in experiencing engagement and success in mathematics, and ways that the written curriculum has room for growth. We found new ways to consider what it means to teach and learn mathematics, including inviting students to (a) bring their full selves to the mathematics classroom (i.e., *academic and social integration*); (b) develop mathematical identities that center their own strength, agency, and resistance to oppressive experiences (i.e., *robust mathematics identities*); (c) recognize the ways power manifests in particular contexts given one's identities (i.e., *intersectionality*); and (d) generate alternative, transgressive, hybrid mathematics social spaces (i.e., *critical consciousness and reclamation*). By building on what was already present within the CPM materials, we were able to imagine alternatives that we argue would strengthen the curriculum's ability to disrupt inequities in mathematics education, both in our educational setting in the U.S. and internationally.

International Connections

We feel confident that a framework informed by the U.S. context that focuses on Black girls will be useful across international contexts because of Black girls' extreme intersectional marginalization. Our focus on Black girls' experiences does not negate the experiences of other groups who have experienced oppression and violence, including within international contexts. Similarly, our focus on textbook materials can be expanded and applied to contexts in which teachers themselves serve as the principal curriculum developers. Curriculum designers, including teachers in every context across the globe, can identify marginalized populations in their own context that they could similarly center. While anti-Blackness is pervasive in the U.S., similar forms of marginalization on the basis of race occur in international contexts (e.g., United Nations, 2016; United Nations Human Rights, 2023). Additional forms of oppression are witnessed in disparate contexts, for instance, on the basis of students' gender identities and sexual orientations (e.g., Watch, 2020) and religious beliefs (e.g., Ochab, 2022).

Significance and Limitations

We present this curriculum analysis with the hope it contributes to a global conversation about ways curriculum materials can increase equitable learning opportunities for Black girls and other particularly marginalized students, to correct for the historic and ongoing harm of low expectations and limited opportunities. We argue that there is promise in selecting a framework like BlackFMP that specifically focuses on the needs and desires of particularly marginalized students. Since mathematics curriculum and reform, both in the U.S. and internationally, has and continues to overwhelmingly support and maintain the status quo (i.e., whiteness), we intentionally used a framework that could support our

understanding of how to design a mathematics curriculum to center and celebrate Black girls. We recognize that many students who have different intersectional identities than Black girls—such as other BIPOC students, and even white students of all genders—would benefit from the curricular revisions suggested in this analysis based on the BlackFMP framework. Dismantling oppression for any group requires battling all forms of oppression, and so centering and celebrating *particularly* marginalized groups allows us to push against some of the most insidious forms of oppression.

By selecting a framework that centers Black girls, we were prompted to acknowledge and imagine what experiencing CPM might be like for Black girls. This reinforced and highlighted the contributions of Eanes Snowden's (Author 3) feminist-oriented teaching practices and lived experiences as a Black girl in a majority white-serving school system. The three white scholars on this project do not have the personal experiences to know what it might be like to be a Black girl in a mathematics classroom. As such, the BlackFMP framework is one starting point for better imagining opportunities for redesigning curricula in ways that increasingly support historically marginalized students, Black girls in particular.

Given the positionalities of three out of the four authors as white researchers and curriculum designers, we acknowledge that building on scholarship by and for Black women and girls is necessary but insufficient because it does not shield us from inadvertently reinforcing whiteness in our analysis, especially through avoiding a problematic colorblind approach. It is through active collaboration with Black women scholars that we continue to learn and to hold ourselves accountable. Given the significant amount of emotional and cognitive labor that it takes to do this work, white curriculum designers, including the three on this project, must actively work to take on the labor of being antiracist and not overburden our BIPOC colleagues with taking on this labor alone.

Although this critical analysis of a secondary written mathematics curriculum demonstrates promise for supporting curriculum designers in attending to students who have historically been marginalized in mathematics classrooms, more is needed. To achieve truly equitable learning experiences, mathematics education and education systems more broadly must be completely reimagined (Martin, 2021). Still, the need is immediate, and teachers and schools are looking for solutions today. In a recent podcast (Jones et al., 2022), Joseph (2021) affirms that her BlackFMP framework is not yet reimagining the mathematics education enterprise, but rather working toward immediate and sustainable changes for marginalized students in today's mathematics classrooms. Though the BlackFMP framework (Joseph, 2021) and this analysis do not dismantle and rebuild mathematics education from scratch, they offer progress via making adjustments from within the system that disrupt problematic educational practices for students in classrooms today. We recognize that BlackFMP is just one framework for navigating the tensions we experience with making necessary and incremental changes to an unjust system.

Contribution to Practice

To support curriculum designers in adjusting their curricula in ways that similarly center particularly marginalized students, we offer heuristic design questions that supported our investigation. We know that not all design questions will be relevant to each task or even each lesson, but nevertheless, we argue that all are essential to designs for curricula that seek to dismantle the status quo. We also recognize that the redesigns suggested in our analysis are not a "simple fix" to bolster the written curriculum's equity work, and our suggestions are just one way, rather than *the* way, the materials could be strengthened. In

addition to acknowledging the strengths of the written CPM curriculum materials and the accompanying professional learning opportunities, we also acknowledge that our analysis of CPM runs the risk of messaging that there is *one right way* (Okun, 2021) to attend to equitable mathematics instruction. We hope we have achieved clarity and transparency that our suggestions for growth are but one of many possible redesigns that could strengthen the curriculum.

Call to Action

We call on curriculum designers and researchers, both within CPM and beyond, to practice regular critical reflection on how their own intersectional identities influence the way they experience the world, mathematics, and education. We also call on curriculum designers to provide opportunities for teachers to reflect on their lived experiences in relation to their students' cultures and communities, and how their classroom practices may perpetuate whiteness and other dominant cultures, so as to develop mathematics curricula that more fully embody the tenets of BlackFMP (Joseph, 2021). We believe that when we engage in this important internal work of critical reflection, we will be better able to identify and acknowledge our own complicity in developing classroom materials that harm, rather than celebrate, particularly marginalized students. As curriculum designers, each of us belongs to social groups that hold societal and institutional power. Recognizing that privilege, responsibility, and perspective is essential in working toward justice in mathematics education.

Concluding Thoughts

In this study, we outline the utility of Joseph's (2021) BlackFMP framework for informing revisions to an existing secondary mathematics curriculum that centers *ambitious mathematics instruction*: CPM's *Inspiring Connections*. While the heuristic design questions were developed as part of the curricular analysis process, we also see promise in using these questions as guides for the development of new and novel mathematics curricula. Moving forward, we look to expand our exploration of how BlackFMP can support a critical reimagining of mathematics curricula earlier in the design process to more fully foreground and recognize Black girls' mathematical brilliance.

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Appendix – Design Heuristic Questions

Designing for Ambitious Mathematics Instruction

Dimensions	Questions for Analysis	Heuristic Design Questions
High cognitive demand	Are there missing opportunities for students to make connections and to think mathematically? Do the tasks lower cognitive demand by over-scaffolding?	How can the task be adjusted to require reasoning and/or making meaningful connections?
Status and equitable participation	Do the curriculum materials enable inequitable patterns of participation to be perpetuated?	How can the curriculum materials be designed so that students are encouraged to participate in collaborative mathematical problem-solving? What supports can be embedded within the curriculum to foster healthy social and academic peer-to-peer relationships in the classroom? What structures can be included to support a healthy and respectful learning community that minimizes status differentials?

Dimensions	Questions for Analysis	Heuristic Design Questions
Access and productive struggle	Do the curriculum materials limit students' opportunities to access the language of and unpack the cultural knowledge of the task?	What adjustments would support student access to sensemaking (e.g., language routines)? What teaching strategies can the curricular materials incorporate to support students in making progress with complex mathematical ideas and relationships? In what ways could curricular materials affirm students' rationales and problem-solving processes?
Make sense of student thinking and build on student ideas	Do the curriculum materials omit opportunities for the teacher to anticipate and formatively assess student thinking?	What probing questions and student group strategies could support teachers in using research-based monitoring and teamwork facilitation practices? How can the curricular materials support teachers to leverage student's mathematical ideas for future conversations and learning? What additional support structures (e.g., professional development, video) could augment teachers' use of the curriculum materials?

About the Authors

Dr. Lara Jasien (larajasien@cpm.org) is Head of Research with CPM Educational Program. Her work is grounded in collaborative relationships with educational designers both inside and outside of schools. Inside of school, Jasien collaborates with designers including curriculum writers, professional learning workshop facilitators, instructional coaches, and teachers to study ways to promote teachers' and students' joint flourishing. She is particularly interested in how teachers' collaborative collegial work can influence students' mathematical experiences across the 6-12 grade band. Outside of school, Dr. Jasien collaborates with learning environment designers to study families' mathematical play. Both in and out of school, she is particularly interested in studying learning in ways that honor both adults' and children's intellectual dignity. She has published her research in top-tier academic journals including the Journal for Research in Mathematics Education and the Journal of the Learning Sciences. Dr. Jasien oversees a competitive research grants program sponsored by CPM Educational Program (cpm.org) that broadly aims to improve 6-12 mathematics education.

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Footnotes

1. We use lower case notation for “white” and uppercase for “Black” to acknowledge that racist white supremacy groups in the U.S. often capitalize “white,” and that lowercasing “white” and capitalizing “Black” decenters whiteness and honors Black people and Black culture. [ref]

2. For example, curriculum materials might include a Laotian woman scientist character working in a lab or Pakistani mothers making job decisions based on competitive wages. [ref]

3. This article represents CPM doing work to critically analyze and reimagine their curricula. This analysis is of a pre-publication version of the materials, so the materials may not appear the same in print. This analysis may or may not result in changes to these lessons but has already resulted in learning that will shape future curricula produced by CPM. [ref]

4. In a Dyad, partners take turns sharing about a topic in a monologue. While one student shares, the other actively listens without judgment or critique. [ref]

5. In this strategy, after individually thinking, student groups discuss and clarify their understanding of the task, then consider strategies for solving. When they reach a consensus on the strategy, they begin the task. [ref]

6. Though the opportunity to examine discrimination is tacit, teachers and students still experience the problem as an opportunity to investigate income inequality. To illustrate, CPM Educational Program received backlash from districts who wish to censor the way this problem offers opportunities to examine discrimination, with one majority-white district even requesting “alternative data” that communicates a different story. [ref]

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