

In Balance the Equation, the Bill & Melinda Gates Foundation's first-ever U.S. education Grand Challenge, we seek to identify partners to design solutions to make Algebra 1 more accessible, relevant, and collaborative for students who are Black, Latino, English Learners, and/or experiencing poverty.

Typical mathematics curricula feature examples and scenarios that normalize middle-class, white culture, such as bungee jumping, using a flag ceremony to celebrate the Fourth of July, launching a toy rocket and drone, and measuring water hoses to fill swimming pools in the backyard. These materials are neither relevant nor responsive to the lived experiences of Black and Brown students. In fact, these examples render Black and Latinx families *invisible*. Thus, mathematical authority is not given to all students in today's classrooms. Instead, how mathematics is currently taught -- centering white students' mathematics traditions and learning styles -- reproduces advantages for white students and disadvantages for historically minoritized Black and Latinx students. As a result, a pervasive opportunity gap exists in mathematics education today. We all know that mathematical competency is a foundational pillar for success in the 21st-century workforce. Yet, only 19% Black and 20% Hispanic eighth graders are at or above proficient, according to the National Assessment of Educational Progress (NAEP, 2019).

Students from all socio-demographic subgroups deserve high quality, data-driven educational experiences to unlock their potential and be equitably prepared to excel after high school graduation, care for themselves and their families, and lower risk of contact with the criminal justice system (Annamma et al., 2019; Morris & Perry, 2017). Delivering a high-quality, culturally responsive mathematics curriculum that reflects the diversity, identities, and experiences of each and every individual in the classroom is the first step towards equitable life and academic outcomes for Black and Latinx students.

Culturally Responsive Math Nation's (CR-MN) design promotes student engagement, academic success, and the development of positive math learner identities among Black and Latinx students. CR-MN is an online math program that enhances the Illustrative Mathematics (IM) Algebra 1 curriculum, using Math Nation as the vehicle to deliver culturally aligned algebra content, a social networking wall where students will explore their identities as learners, and a space for students to set and track their mathematics learning and performance goals. This content allows students to see themselves reflected in Mathematics, facilitating the growth of their identity as competent mathematicians. It also supports teacher efficacy incorporating culturally responsive content in the classroom. Math Nation's online platform is already utilized by over 650,000 students and 30,000 teachers, and features videos from a diverse set of tutors, practice problems, assessments, and robust teacher resources.

The key features that characterize Culturally Responsive Math Nation (CR-MN) are:

- **Culturally Responsive Instructional Videos:** Each instructional unit in Math Nation features a series of videos addressing all of the topics in the unit. Each topic is presented by multiple instructors, allowing students to choose their preferred teacher. The instructors represent a diverse range of ethnicities, ages, and styles, promoting student voice and choice in their education journey. Furthermore, the instructional content will be presented using culturally responsive scenarios that are cultivated in partnership with current students, their families, and their teachers. The contextualization of learning in engaging content will help students find

purpose and confidence while learning algebra, connecting to their interests and presenting evidence that this is a necessary skill for success in life beyond high school.

- **Independent Practice Problems:** Students will engage in additional practice by completing standards-aligned, culturally relevant problems in the CR-MN platform. These problems provide additional opportunities for students to monitor their progress, identify areas to improve, and prompt them to think about how they can set and monitor their academic goals to meet success in areas of improvement.
- **CR-MN Student Wall:** The Math Nation Student Wall presents students the opportunity to engage in a social media-style feed that is moderated by Guides to collaborate with each other. The students share perspectives, reflections and strategies, but also offer support to each other. The Guides moderate discussions, point to helpful resources, and incentivize student learners to help one another by awarding Karma Points. In CR-MN, this tool will allow students to answer prompts about their engagement in CR-MN and their developing identities as mathematics learners. The Student Wall can be used as an intervention for students who need support or as independent practice for students who are able to offer support.
- **Goal Setting and Monitoring Progress:** Students will use the multiple formative and assessment tools to set goals and monitor their progress in meeting goals.
- **Assessments:** Students assess their performance through formative assessments of the concepts learned through instruction. Teachers are able to view reports of how students have done to plan their instruction.
  - **Check Your Understanding:** Formative assessments consist of up to three practice questions that align with the content of each instructional video. All assessments within CR-MN align with the modes in which students will be asked to demonstrate competence on state assessments, featuring drop-down, multiselect, and other question types.
  - **Pretest and Test Yourself! Posttest:** Formative Assessments at the start and end of each unit to assess learning during the unit.
- **Teacher Professional Development:** These sessions aim to help teachers understand the standards and adopt a culturally-relevant and technology-enhanced instructional approach to helping students master those strategies. Math Nation offers teacher professional development beyond the basic use of the hybrid resources it offers. Math Nation offers opportunities for ongoing professional learning through a variety of virtual resources, as well as in-person professional development sessions, centered on research-based, innovative approaches to classroom teaching and learning. We will provide a custom training for Algebra 1 teachers participating in this research.
- **CR-MN Teacher Wall:** The Math Nation Wall presents teachers the opportunity to engage in a social media-style feed that is moderated by Guides to collaborate with each other. The teachers share perspectives, reflections and strategies, but also offer support to each other. Additionally, teachers will use the Teacher Wall to reflect on the CR-MN curriculum as well as their own use of culturally responsive teaching strategies.

The following priority students will use the solution: Black and Latinx students (including those who are English learners) who are taking Algebra 1 in high school. This solution targets Black and Latinx Algebra 1 students and will be piloted in Charleston County School District (CCSD).

Our solution aligns with three primary Balance the Equation areas of focus.

- *Improves Relevance of Algebra Content* by drawing on culturally relevant and responsive teaching frameworks to build content that taps into the interests and experiences of Black and Latinx students and parents. We will use focus groups with parents and students to identify contextually rich, everyday scenarios in which to embed within the mathematics content.
- *Empowers and Strengthens Teacher Practices* by giving teachers an opportunity to 1) reflect on the extent to which they engage in culturally responsive teaching, 2) identify impediments to engaging in culturally responsive teaching, and 3) receive professional development regarding how to use CR-MN to support mathematics instruction in the classroom.
- *Develops New or Better Feedback Mechanisms* by creating opportunities for students to set goals, monitor their progress, and develop a metacognitive awareness of how they think of themselves as mathematics learners. The platform will also provide support to help strengthen their mathematics learner identities through CR-MN Student (social media style) Wall. These feedback mechanisms will be used to make instructional decisions regarding students' access to algebraic content.

Our solution responds to the needs and interests of Black and Latinx students and the community by adapting the existing materials based on the results of interviews conducted (in Phase 1) with Black and Latinx students, their teachers, and their parents. We identified areas where the existing curriculum is not meeting their needs or could be better aligned with their personal experiences and racial and ethnic identities, based on a series of interviews conducted with students and parents in CCSD. This approach was implemented given that mainstream curriculum does not reflect the diversity of students who attend schools in the United States. Most curricula are designed on the basis of white, middle-class preferences (Kincheloe et al., 1998) and do not include the contributions of Black and Latinx people (Chamberlain, 2005; Ladson-Billings, 1994, 1995). Furthermore, curricula do not include the cultural styles and interests of Black and Latinx students (Gay, 2000; Villegas & Lucas 2002).

We conducted interviews with students, teachers, and parents of priority students to gain insight into what topics might be culturally responsive to them. We used this content to create culturally responsive contextual scenarios for students to choose from on the Math Nation platform. This constitutes Culturally Responsive Math Nation (MN). Additionally, we created prompts within CR-MN for students to discuss their math identities and sociocultural issues on the platform's social networking wall, and created prompts designed for goal setting and monitoring.

Our solution differs from existing practice in three main aspects: curriculum, instruction, and culturally responsive online spaces.

- First, we will develop a culturally responsive, digitally-enhanced curriculum (CR-MN) and refine it based on feedback from the students, teachers, and parents to authentically reflect their unique needs and interests.

- Second, the CR-MN will be delivered by video instructors with diverse backgrounds in race, gender, and language to align with student identities and empower teacher practices.
- Third, the Math Nation social networking wall will be used as a space for CR resources and materials to complement the CR teacher training around the CR-MN and for exploring students' math learner identity and skill development.

These three features differ from existing practices that do not address Black and Latinx students' interests and needs (c.f., Villegas & Lucas, 2002), and that often fail to engage students with culturally responsive materials in digital settings.