Practices for Equitable and Culturally Responsive Secondary Math Instruction Practices for Equitable and Culturally Responsive Secondary Math Instruction

How to Use this Memo

The purpose of this memo is to summarize the literature focused on racial equity-centered math instructional interventions for minoritized youth and highlight effective practices. It is one in a series for organizations doing continuous improvement work. The content is divided by research and practices. We have identified the context of each example: at the school **[SCH]**, organization **[ORG]**, classroom **[CLASS]**, or district level **[DIST]**. However, the practices in each example could be used in a variety of settings depending on the need.

Framing Equity-based Math Instructional Practice

How does race impact mathematics education? Mathematics is often thought of as race-neutral: how can numbers be racialized? Decades of research show how racism impacts students' experiences as mathematics learners at multiple levels, through policies, school and classroom practices, curriculum, and individual interactions. In response to this, anti-racist work also happens on multiple levels, from individual classroom interactions to school-wide and policy decisions.

For example, race-neutral approaches to math education policy ultimately situate whiteness as the status quo and goal, an approach that plays a role in (re)producing racial inequity in U.S. society more generally (Gutiérrez, 2002; Martin, 2009; Moses & Cobb, 2001; Tate & Rousseau, 2002). Tracking is a perfect example of this, as it reinforced racial segregation immediately following school desegregation (Tate & Rousseau, 2002) and continues to perpetuate racist conceptualizations of math abilities of students of color. However, districts such as San Francisco that have eliminated tracking have seen an decrease in the percentage of Black, Latinx, and English Learner students needing to repeat Algebra 1 and an increase in the percentage who enroll in advanced math courses (Berwick, 2019).

Racism also impacts students' mathematical identities and thereby affects their ability to learn in the classroom. Learning opportunities are structured by societal racial narratives (Martin, 2009) where White and Asian students are expected to excel at mathematics, whereas Black and Latinx people are not (Martin, 2009; Shah, 2017). These often implicit expectations shape individuals' mathematical identities, and this matters both for teachers' implicit biases that frequently prevent them from offering high-quality instructional opportunities to Black, Indigenous, and Latinx students (Lewis & Diamond, 2015), and for students' perceptions of their peers and of themselves as math learners (Shah, 2017). Rather than neutral spaces, we need to understand "classrooms as highly racialized spaces in which teachers and students participate in a range of practices in which they develop, contest, and internalize beliefs about what counts as math literacy and who is mathematically literate" (Martin, 2009, p. 315).

CORE TENETS OF AMBITIOUS MATH INSTRUCTION

Mathematics education researchers have argued for a focus on teaching mathematics concepts rather than just fluency, or what is often called "ambitious math instruction" (Lampert, Beasley, Ghousseini, Kazemi, & Franke, 2010). Ambitious math instructional practices engage students in adaptive critical thinking and problem solving towards a broad approach to guantitative reasoning (Lampert et al, 2010; Munter, 2014). These practices differ from conventional math instruction, which often isolates math skills to memorize, rather than learn them as part of broad reasoning. Moreover, conventional approaches focus on computation and following directions. Ambitious math instructional practices are the foundation of equitable math instruction because they engage students in complex thinking that ultimately increases their capacity to succeed in high-level math. For example, a five-year longitudinal analysis of high school students learning with ambitious math resulted in improved academic performance from students who were mostly of color and low-income (Boaler & Staples, 2008).

Much of the research on ambitious mathematics is concerned with how teachers can learn and adopt ambitious instructional practices in the classroom. Examples of ambitious math practices are choosing complex math tasks that build skills, reflecting on and using student errors, and using homework equitably (Wadell, 2014). Ambitious math practices do not explicitly consider equity and cultural responsiveness. Instead, the mathematics education field has had an implicit theory of action towards equitable opportunities and outcomes: if teachers learn ambitious math instructional practices, they will realize that all students are able to do mathematics at high levels and will therefore offer the high leverage practices to all students. This implicit approach has not panned out; teachers' implicit biases and systems designed to reify White supremacy continue to prevail. In response, there is a growing field of mathematics education that focuses explicitly on equity and racial justice. We synthesize this literature below.

Actions for Equity: Organizational Conditions for Equitable Math Instruction

The research on conditions that foster equitable math instruction is still emerging. The following school-level practices foster equitable math instruction:

PARTNERING WITH FAMILIES AND COMMUNITY MEMBERS

This develops students' identities as mathematicians and helps "mathematize" everyday practices. Partnering in this sense involves both sharing academic work and involving families and community members in decision making.

- Evidence from researcher-led workshops for parents (Jay, Rose, & Simmons, 2017) and case studies of Latinx families in a Texas city (Williams, Tunks, Gonzalez-Carriedo, Faulkenberry & Middlemiss, 2020) suggest that connecting math learned in class with math happening at home by incorporating parents can help students develop math problem-solving. More specifically, Jay, Rose, & Simmons (2017) observed that repositioning family cultural practices as mathematical practices can create spaces where students build mathematical identities that include their racial and cultural identities. For instance, children often participate in family budgeting, selection of utility providers, discussions of time and rate (particularly with sports) etc. Facilitating families' "mathematizing" of these processes can increase student engagement and self-efficacy.
- Schools should center families as sources of data and knowledge and as authorities on math instruction (Ishimaru, Barajas-Lopez, & Bang, 2015). In a study that asked Black-identifying college students to reflect on their persistence in math throughout their education, researchers found that adopting an asset-based view of parent and community expertise increases students' math self-efficacy and perseverance (McGee & Spencer, 2015). An example of taking an asset-based view is to focus on the attitudes or dispositions that parents instill in their children that help them in the math classroom.
 - → Denver Public Schools (DPS) uses <u>feedback loops</u> to collaborate with parents and students. These allow them to build trust, work with the whole family rather than just students, and make sure that family involvement is ongoing and varied. [DIST] [ORG]
 - → Eskolta uses this protocol, designed in partnership with their network schools, to elicit student feedback and ideas about how the network should focus their improvement efforts. This allows the network to hear directly from students, thus promoting equity of voice in network goal-setting. [ORG]

- → Rather than continuing to support exclusively adult and educator-driven continuous improvement, DPS strives to "welcome, foster, and liberate student and family voices" (slide 4 of the <u>Network Convening Deck</u>). This deck also includes an example driver diagram. [DIST] [ORG]
- → TODOS: Mathematics For All, a professional organization that advocates for equity and excellence in mathematics education, has a guide to <u>student and family-centered</u> <u>mathematics assessment</u> which suggests involving parents in assessing student engagement, confidence, and home learning environment, identifying familial resources for learning mathematics, and providing feedback to teachers and their children. [SCH]
- → Schools can make parent-teacher meetings more accessible by holding them at times that are convenient for parents, making the classroom space comfortable for adults, using a language that parents are comfortable speaking in, providing childcare, and meeting in a convenient location. This resource also suggests having a specific purpose for the meeting, planning and working together, and providing leadership opportunities for parents. [SCH]

A SCHOOL-LEVEL COMMITMENT TO EQUITABLE MATH INSTRUCTION

Schools should foster a community-based notion of equity rather than a top-down approach (Washington, Torres, Gholson, & Martin, 2012). This means that the school's definition of equity in math instruction should mirror the community's understanding of equity. Some of the practices listed in this section are examples of ambitious math, but are not specifically tied to racial equity. We envision leveraging the practices of ambitious math to support racial equity. For instance, de-tracking along with using a curriculum like New Visions' could provide opportunities for students to collaborate and reflect in a racially and ability diverse classroom.

- In a mixed-methods study of nine high schools, Gutiérrez (2012) found that "a rigorous and common curriculum, commitment to a collective enterprise, and commitment to students and innovative instructional practice" improved student outcomes (p. 22). The common curriculum meant students had a streamlined path to achieving math graduation requirements and a culture of taking advanced math classes. The "collective enterprise" entailed a community of practice among teachers who rotated course instruction and shared teaching practices with one another. To commit to students, teachers had steadfast asset-based views of students, particularly those repeating math courses.
- Part of this school-level commitment to equity involves eliminating ability tracking and grouping (Gresalfi & Cobb, 2006). This <u>report</u> from WestEd, which examined transcripts and course-taking patterns of 24,000 Californian students, found that an accelerated math pathway does not support students unless they are already proficient in math by grade 7. Students in the study who did not take Algebra 1 in 8th grade were more likely to repeat courses and less likely to score proficiency on California's state math test.

- → New Visions has a <u>common math curriculum</u> designed specifically for blended remote and in-person learning, as well as innovative <u>instructional routines</u> designed to foster collaboration, productive persistence, and reflection. [ORG]
- → TxNSI used <u>this book</u> in their professional learning series focused on increasing discourse in math classes. There is also a high school-focused <u>version</u> of the book. The five practices highlighted in both are setting goals and selecting tasks, anticipating student responses, monitoring student work, selecting and sequencing student solutions, and connecting student solutions. [ORG] [SCH]
- → This Edutopia article describes how the San Francisco school district eliminated tracking, resulting in a lower Algebra 1 repeat rate for Black, Latinx, and English Learner students and higher enrollment in advanced math courses. It also resulted in higher standardized test pass rates for middle school students in the district. However, some parents feel that delaying higher level math courses is limiting their children's access to competitive colleges, and cite the compressed Algebra 2 and Pre-calculus classes that students must take in order to fit Calculus in before high school graduation (Tucker, 2019). This slide deck details the thought behind the transition, beginning with the premises that "All students are mathematically brilliant" and "Math is a web (not a ladder)" on slide 7. [DIST]

PROFESSIONAL LEARNING SHOULD HELP TEACHERS NEED TO UNDERSTAND

THEIR OWN RACIAL POSITIONALITY (Waddell, 2014; Battey et al., 2018) This involves self-reflection as well as shifting mindsets to believe that their students can succeed at math (Gutiérrez, 2016).

- Understanding their own positionality means that teachers engage in critical self reflection to understand their role as agents of change in using mathematics to empower students (Martin, 2007 as referenced in Davis & Martin, 2008). They examine their practices in context to learn how to promote positive math identity development for Black, Indigenous, and Latinx students (Martin, 2009).
- Teachers should learn to combat deficit perspectives of their students of color (Gholson & Martin, 2012; Gutiérrez, 2012). They have to believe that their students can succeed and provide them with rigorous coursework (Gutiérrez, 1996). This means the teacher's role is to build from the mathematical thinking that students bring to the classroom as a jumping off point for new learning (Gresalfi & Cobb, 2006).
 - → <u>A Pathway to Equitable Math Instruction</u> has a <u>set of exercises</u> for math educators to use in reflecting on their own biases and learn about transformative instruction. [SCH]
 - → Eskolta provides their members with <u>training</u> that prompts critical self-reflection for the purpose of creating more culturally responsive systems. Through these trainings they communicate to educators the ongoing nature and parallel paths of self-work and relational and institutional work (slide 17). They also have an empathy interview structure

(slide 13) that encourages students to communicate with their teachers about what works well for them in school and what motivates them. Although this is not specifically focused on math, reflective teaching and learning is key to ambitious math practices. **[ORG] [SCH]**

- → Bank Street is encouraging teachers to use exit tickets to learn more about students' math learning and identity development, which they will then use to plan follow-up lessons. One example is the "Triangle-Square-Circle" protocol from <u>The Teacher Toolkit</u>, which uses the shapes to prompt students to write three important points, one thing that "squares" with what they already knew, and something that is still "circling" or that they are still thinking about. [CLASS] [SCH] [ORG]
- → TxNSI uses <u>this resource</u> from Community Design Partners to structure empathy interviews, which includes sections on planning, designing your questions, and preparing your team. It specifically prompts interview teams to look beyond people with "average" experience to capture the viewpoints of students and families who have been historically marginalized. The protocol also highlights the presence of power dynamics that might be present in an interview and suggests that the team works to reduce harm. Finally, it suggests that the interview team include students, families, and community members as interviewers. [ORG]

Actions for Equity: Instructional Practices

Not only does anti-racist teaching necessitate teachers' evaluation of their own racial identities, it also requires that teachers understand and develop their students' identities, specifically regarding race and math skills. Teachers can do this by valuing and utilizing the knowledge that students bring to the classroom and structuring their classroom activities to promote equitable participation.

TASKS THAT VALUE AND BUILD ON STUDENTS' PRIOR KNOWLEDGE

Teachers should *make connections to students' lives outside of the classroom and treat the knowledge that students bring from their experiences as valuable in learning and using mathematics* (Bartell et al., 2017; Esmonde & Caswell, 2010; Hand, 2012; Ishimaru, Barajas-Lopez, & Bang, 2015; Moses & Cobb, 2001; Nasir & McKenny de Royston, 2013). This means that teachers must also structure tasks so that students learn to value each other's knowledge. Tasks should help students develop identities as mathematicians and position math as a tool for combating social injustices.

- Anti-racist math instruction should build on identities that students bring to the classroom to incorporate mathematics (Nasir, 2002). Acknowledging student contributions can encourage students to think of themselves as mathematicians (Battey et al., 2018). This implicitly values their community funds of knowledge. Utilizing community math practices allows teachers to draw on multiple mathematical knowledge bases to make connections between mathematical and cultural knowledge (Aguirre et al., 2013; Esmonde & Langer-Osuna, 2013; Martin, 2009).
- Connections that students make to other cultures should go beyond other cultures in general and focus on the students' individual community, prioritizing students' needs in addition to math learning (Gresalfi & Cobb, 2006; Rubel et al., 2016; Gutiérrez, 2012). In supporting students to develop identities as mathematicians, teachers are also helping students develop a sociopolitical disposition and can increase student understanding and engagement in instruction (Bartell et al., 2017; Nasir & McKenny de Royston, 2013; Rubel, Lim, Hall-Wieckert, & Sullivan, 2016). To accomplish this, teachers should help students conceptualize mathematics as a tool to combat societal injustices, potentially through healing practices (Gutstein, 2003; Kokka, 2019).
- Rubel et al. (2016) investigate an example with a place-based mathematics problem investigating lottery spending in students' neighborhoods. This project led to increased student engagement and participation among students who typically felt bored in their remedial math class.
- Privileging multiple forms of discourse and emphasizing collective responsibility provides opportunities for students of color to engage in

mathematics learning (Bartell et al., 2017; Esmonde & Langer-Osuna, 2013). Boaler & Staples (2008) list roles, multiple ability treatment (providing varied tasks that not all students can succeed at), assigning competence (believing that students are capable) and interdependence as strategies to positively structure group interactions and address status issues.

- → This <u>article</u> from the American Mathematical Society's blog has suggestions for educators to support diversity and inclusion in their classrooms, including using students' interests in contextualized tasks, and exposing students to a diverse group of mathematicians.
 [CLASS] [SCH]
- → Get the Math has a <u>lesson plan</u> that similarly asks students to consider the ways they use math in basketball. They also have math in <u>fashion</u>, <u>video games</u>, <u>restaurants</u>, and <u>special effects</u> lessons. [CLASS] [SCH]
- → <u>TxNSI</u> is introducing ways to discuss race by holding "Improvement for Equity" roundtables. The first roundtable will focus on eliminating deficit thinking and getting started with empathy interviews. [ORG]
- → An example from Gutstein (2003) includes using math skills in a project on racism in housing costs, simulating the distribution of world wealth by continent, and investigating the standardized test scores of different demographic groups (students of color vs White students, males vs females; and low income vs high income students). [CLASS] [SCH]
- → Nasir & McKinney De Royston (2013) discuss an example of students using different strategies to solve math problems related to basketball based on context (within school or at a basketball game). A sociopolitical orientation towards instruction pays attention to the different forms of cultural capital used in each context--for instance, what knowledge do students bring as players that's unique and valuable at a game? [CLASS] [SCH]
- → Healing practices described by <u>Made for Math</u> include building rapport, using a math journal to give students an opportunity to write about their feelings regarding math, practicing empathy, and facilitating successful math experiences. [CLASS]
- → This <u>article</u> from the American Mathematical Society's blog has suggestions for designing assessments and assignments with a variety of response types and encouraging students to have a growth mindset. [CLASS] [SCH]

STRUCTURED PARTICIPATION

Historically, power in disciplines like mathematics and science has belonged to White people, but by *utilizing discussion norms that promote equity and creating a classroom environment where mathematics ability is viewed as learned rather than innate and students are comfortable struggling productively*, teachers can support their students of color in claiming their own mathematical identities (Agarwal & Sengupta-Irving, 2019). Additionally, tasks should be structured so that they are cognitively demanding and evaluation should focus on conceptual understanding rather than correct answers. We recognize that curricular choice is not always in the hands of teachers, so we have included suggestions here for curricular implementation.

- Teachers can structure their classrooms to support participation from students of color who may not see themselves as mathematicians by *making norms and expectations clear* (Munter & Haines, 2019; Wilson et al., 2019). Norms can position students as capable and attend to how students position each other (Bartell et al., 2017). Teachers can also *re-frame mathematical ability as learned*, rather than innate, to help students of color to see themselves as mathematicians (Battey et al., 2018; Wilson, Nazemi, Jackson & Garrison, 2019) and set anti-racist norms by *setting a supportive emotional tone for their classroom* (Battey et al., 2018).
- Math tasks should be cognitively demanding and scaffolded so that students have the tools to succeed (such as habits of mind and participation structures) (Boaler & Staples, 2008; Brown, Boda, Lemmi & Monroe, 2019; Rubel, 2017). Supporting students in their productive struggle to learn math reinforces the idea that they are capable (Bartell et al., 2017; Wilson et al., 2019). In Boaler & Staples' (2008) study, teachers supported students to complete cognitively demanding mathematics tasks by reiterating that success comes from hard work and teaching students learning practices.
- When evaluating student learning, teachers should focus on conceptual understanding and mathematical validity of students' ideas (Gresalfi & Cobb, 2006; Gutiérrez, 1996).
- Structuring tasks so that students have to draw on each others' expertise and thus depend on each other helps students learn to value each other's knowledge (Cohen, Lotan, Scarloss & Arellano, 1999). When there are more ways to succeed, students realize that several different practices are valuable and more students can feel successful (Boaler & Staples, 2008). Encouraging students to use their own forms of discourse can also help students learn to explain and justify their answers to mathematical problems (Boaler, 2002; Wilson et al., 2019).

→ A Pathway to Equitable Math Instruction also has a resource called "<u>Creating Conditions</u> <u>to Thrive</u>," which focuses on supporting students' social, emotional, and academic development. [CLASS]

- → San Francisco School District has <u>sample norms</u> such as "Errors are gifts that promote discussion," alongside a protocol for establishing and reinforcing norms. [DIST]
- → Bank Street lists <u>four socio-emotional learning check-ins</u> that are focused on math with possible modifications, such as Rose-Bud-Thorn-Gardener, which asks students to reflect on a highlight, a new idea, a challenge and someone who can help the student with the challenge. The other ideas are Appreciation, Apology, Aha!, Current internal playlist, and Notice, Wonder & Feel. **[ORG]**
- → This <u>white paper</u> from the Dana Center and Collaborative for Academic, Social, and Emotional Learning [CASEL] describe the "ideal classroom" that integrates SEL practices and mathematics instruction. In the classroom, the teacher is a content and instructional expert who can also provide students with robust mathematical tasks and create a trusting and inclusive environment. This resource includes a table demonstrating the connections between the common core and SEL competencies. [CLASS] [SCH]
- → This instructional guide for use with this swimming pool activity from Inside Mathematics is an example of a lesson that incorporates SEL competencies and math standards.
 [CLASS] [SCH]
- → This <u>article</u> from GettingSmart has suggestions for how to support mathematical discourse in the classroom so students can engage in "productive struggle" and "use a variety of approaches to convey their knowledge and solution strategies". [CLASS]
- → Suggestion number 8 in this <u>article</u> from TeachThought provides ways to help students learn from their mistakes to develop deeper conceptual understanding. [CLASS]
- → Number 4 in <u>this article</u> from Understood gives strategies to use in structuring peerto-peer interactions such as pre-teaching how to have discussions, encouraging discussion of different approaches, and time for collaborative reflection on individual work. [CLASS]
- → Bank Street has <u>four ideas</u> for math discourse routines that provide students with regular opportunities to discuss math with each other. They include Which one doesn't belong?, I notice...I wonder, Fishbowl, and Compare and Improve. [CLASS]

Resources

https://equitablemath.org/

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