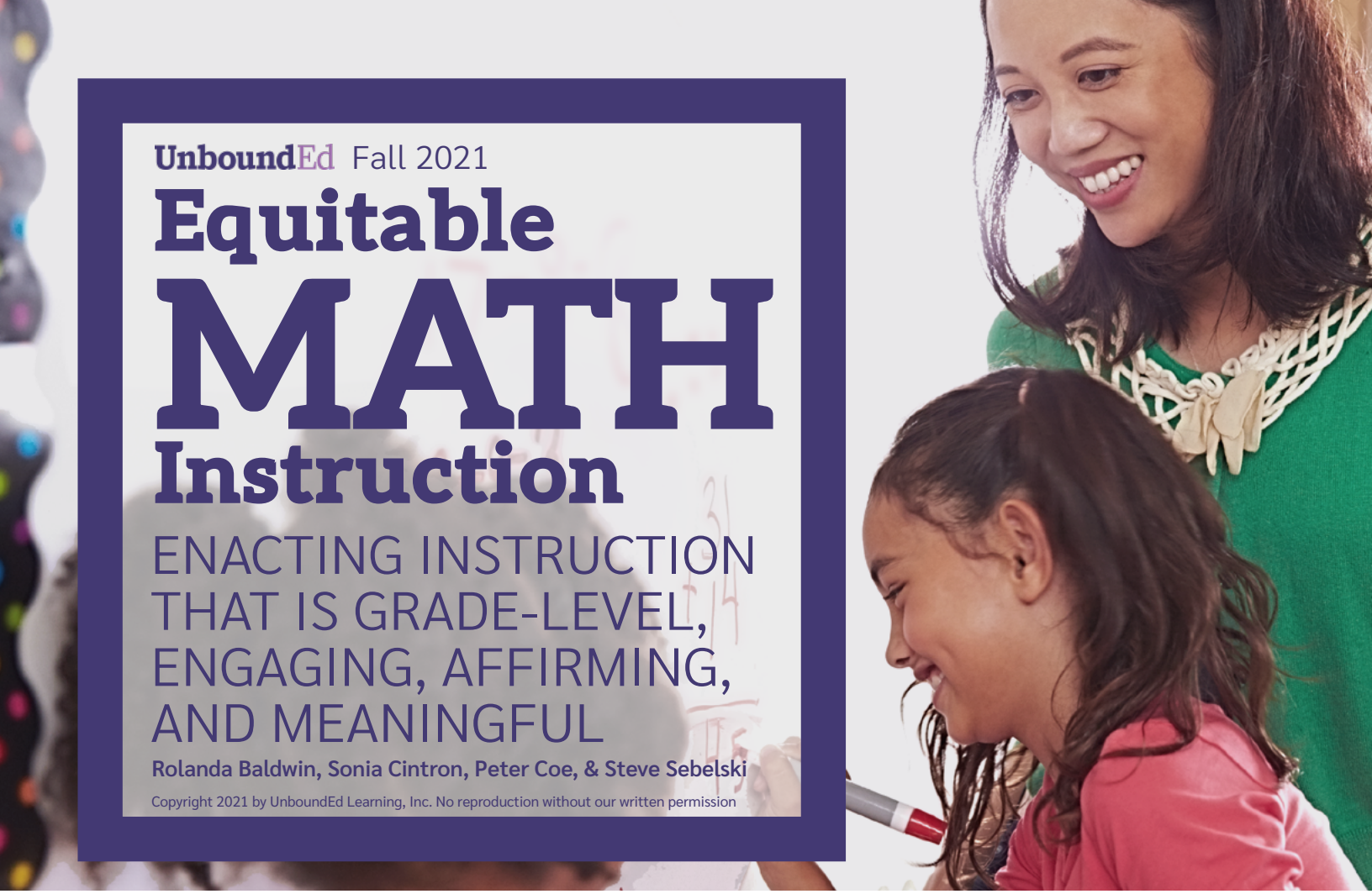

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Equitable MATH Instruction

ENACTING INSTRUCTION THAT IS GRADE-LEVEL, ENGAGING, AFFIRMING, AND MEANINGFUL

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Doing mathematics is inextricably linked to freedom. In K-12 mathematics education, this is sometimes discussed with an explicit focus on financial independence, as mathematicians are often thought of as having lucrative, high-status careers that allow a certain kind of freedom. But there is much more to mathematics for us to consider. Doing mathematics supports us as we navigate our daily lives, make sense of politics, history, and nature, and take positions of protest and advocacy. As we seek out inequities and work to correct them, it helps to examine how our world is changing and consider, "What is equitable?" Doing mathematics is critical as we dismantle systemic racism, solve our climate crisis, bring healthcare to all, and progress as a society. Using mathematics to understand the world, expose injustice, and advocate for change is central to one's liberation and independence.

Then, it stands to reason that in the United States, where the idea of freedom permeates our national culture and discourse, cultivating strong mathematics students would be a top priority for our schools. And yet, when compared internationally, students in the United States demonstrate mathematics knowledge and skills at lower levels than many other countries.[1] Unfortunately, mathematics instruction in this country has overwhelmingly been characterized by procedural practice,[2] disjointed topics, and frequent review.[3] Too many students in the United States are denied the opportunity to learn mathematics deeply. And while inadequate mathematics instruction is a nationwide phenomenon, affecting students in every state,

of every race, and every means, its effects fall disproportionately on students and families of color. As a country, we must acknowledge that progress in mathematics education without eliminating racial inequities is not progress.

"Racial inequity is when two or more racial groups are not standing on approximately equal footing," according to Dr. Ibram X. Kendi in his book, *How to be an Antiracist.* What are the racial inequities in our educational system? Racial inequities were built into the American model of education and are present in almost every imaginable facet of schooling. Black and Indigenous students of color (BISOC) go to schools that are underfunded[4] and less likely to offer advanced mathematics courses.[5] Their school leaders and teachers are more likely to dole out punitive disciplinary actions to them[6] and less likely to place them in higher-tracked classes.[7] Their teachers are less likely to be experienced;[8] their teachers are also often white and hold lower expectations when compared to Black teachers.[9] And while students' learning is an area where we would very much expect "approximately equal footing," the racial disparities in standardized test results are yet another feature of this inequitable system.

Analyzing students' learning with a focus on students' deficits perpetuates racism and ignores institutional power; educators must instead work at all levels of the system to fundamentally change the educational experiences consistently provided for students of color.

Making progress requires that educators take this systemic view. Analyzing students' learning with a focus on their deficits results in measuring students against dominant cultural norms that are ingrained in institutional power when, in fact, there are multiple ways students can demonstrate "proficiency." We must instead work at all levels of the system to fundamentally change the educational experiences consistently provided for students of color. Doing so takes the collective work of educators, coaches, and leaders at all levels of our educational system.

This paper explores equitable mathematics instruction as one element of many required to make schools more equitable. A school's mathematics curriculum, the set of materials used to craft instruction each day, is a significant teaching and learning tool that provides access to the power and opportunities afforded by mathematical proficiency. Instruction, the events, activities, and interactions between students and teachers that happen every day, is closely tied to the school's curriculum. Instruction extends beyond materials as a manifestation of each teacher's actions, expectations, and professional judgements.

Equitable math instruction means that educators ensure all students have access to a standards-aligned curriculum that provides opportunities for rich tasks and for developing deep understanding. They enact instruction in ways that resonate with students, affirm their developing identities, and connect mathematics to social justice. It also means, where necessary, that educators provide supports that allow all students to persist successfully in the work of an aligned curriculum. It further means that they provide targeted intervention to address unmet needs when students do not experience success, even with support.

Our vision of effective and equitable instruction requires that educators do three things:

1. Adopt an aligned curriculum.

2. Enact core instruction that is engaging, affirming, and meaningful for students, including instructional support that fosters all students' persistence with grade-level tasks.

3. Provide targeted intervention in addition to and in service of grade-level learning.

This is not a "how-to" document. There are no step-by-step instructions; it does not contain curricular materials or addresses context-specific concerns. Through this paper, we hope to build awareness of a definition of equitable mathematics instruction with a focus on these three foundational "moves." This paper will emphasize that these moves, which require the coordinated efforts of educators throughout our school systems, create conditions for mathematics instruction to be truly equitable.

1. Adopt an Aligned Curriculum

Adopting an aligned curriculum is a critical first step toward equitable instruction. High-quality curricula that are well aligned to college- and career-readiness standards have the potential to provide significant opportunities for marginalized students to experience more equitable mathematics instruction.

Recent standards-based reform efforts, including the National Council of Teachers of Mathematics (NCTM) Principles and Standards and the Common Core State Standards for Mathematics have helped highlight and codify evidence-based practices. Standards-aligned curricula employ the Common Core instructional shifts as design principles. They feature a balance of concepts and procedures along with rich, grade-appropriate application tasks and frequent opportunities for student discourse and sense-making. They also present a vision of mathematics that focuses on the most important learning for algebra readiness and college and career. Finally, the mathematics of aligned curricula is, by necessity, coherent; there is a logical story told within and across grades.

Developing aligned curricula is a time-consuming and expensive process that, in many cases, takes years. It is unlikely that individual educators can create their own materials with the same careful standards alignment, consideration of proven instructional practices, and coherently sequenced learning evident in aligned curricular materials developed by experienced curriculum writers.

It is even more unlikely that "do-it-yourself" curricula will sequence learning both within and across grades. The time-consuming practice of developing aligned materials requires significant resources for development, iteration, and editing and unique expertise in standards, pedagogy, learning science, and written communication. Still, most teachers demonstrate this inequitable practice, reporting more frequent use of materials developed by themselves or with colleagues.[10] This "do-it-yourself" approach often results in assignments that lack cohesion and alignment and may contribute to the fact that students, especially students of color,[11] are often given assignments featuring mathematics that is below grade-level or that is procedurally focused.[12] By contrast, adopting a set of high-quality instructional materials offers a focal point around which the coordinated efforts of teachers, coaches, and leaders can systematically provide all students with a rich vision of mathematics.

The effects of curriculum on student achievement have also been shown to persist for multiple years[14] and to exceed the impact of teacher quality.[15]

Further, research points toward the fact that using a standards-aligned curriculum positively impacts student learning. For example, standards-aligned curricula lead to greater conceptual understanding and problem-solving ability.[13] The effects of curriculum on student achievement have also been shown to persist for multiple years[14] and exceed the impact of teacher quality.[15] Beyond the impact on student learning, adopting an aligned curriculum can anchor instruction and the educator community. In addition to providing rigorous tasks to center daily instruction, adopting an aligned curriculum offers common language, tasks, and approaches for administration and staff to have conversations about grade-level standards and instruction; this dialogue with tasks at the center is necessary for equity. With an aligned curriculum, teachers can shift from complex and exhausting lesson design to lesson preparation; they can redirect their autonomy and creativity toward preparing for instruction. In particular, focus can be directed to understanding students' identities, interests, and where and how students will need support for learning; rather than creating a curriculum, educators can spend their time planning instruction that will be maximally effective for their students.

Designing a coherent curriculum is essential for equitable instruction, but it is an almost impossibly challenging task. Adopting aligned curriculum is not sufficient on its own. Bringing that curriculum to life relieves a system of the stress on resources required to make a curriculum while also ensuring that all teachers have a strong basis for planning and enact equitable instruction each day. It allows a shift from focusing on what to teach to how to engage all students in learning.

2. Enact core instruction that is grade-level, engaging, affirming, and meaningful.™

Bringing a standards-aligned curriculum to life by enacting grade-level instruction that is engaging, affirming, and meaningful is the next key move for educators.

Research has shown that while adopting an aligned curriculum is likely to affect student achievement positively, a curriculum will not, by itself, ensure that every student has access to high-quality instruction.[16]

Examination of Bias, Racism, and Identity

Enacting equitable instruction means seeing, welcoming, and including the full humanity of all of our students. When educators acknowledge the pervasive racism within and by which our K-12 system operates, they avoid unknowingly and implicitly carrying notions of racial hierarchy into the classroom, especially because racism can work in ways that may not be readily noticeable. As mathematics education scholar Dr. Danny Martin notes, "Mathematical illiteracy is not a naturally occurring trait of Black children but has become a widely accepted signifier for Blackness, subject to, and deserving of, violent description and intervention."[17] Defining Black students as typically low-performing in mathematics is so ingrained in society that it may not be readily acknowledged as racism and may influence instruction, despite best intentions.

Additionally, scholars have defined several white cultural norms[18] that teachers may carry into the mathematics classroom, such as a sense of urgency, quantity over quality, and only one right way. These norms look like requiring that students always do mathematics quickly, do large numbers of repetitive, low-level exercises, or use a single method prescribed by the teacher. These requirements not only embody white cultural norms but also run counter to evidence-based best practices for mathematics instruction, which include slow, methodical process of building conceptual understanding to lead to procedural fluency,[19] encouraging use of a variety of solution methods,[20] and engaging students with cognitively demanding tasks that promote reasoning.[21] While automaticity with math facts and fluency with symbolic manipulation are appropriate goals at many grade levels, they represent the culmination of gradual development of conceptual understanding. When white cultural norms are implicitly held as prerequisites for doing mathematics, assimilation and marginalization can occur, where white students' language and behaviors are more welcome than those of students of color.

Enacting equitable instruction requires examining bias, racism, and identity and supportive, culturally responsive curricular adaptations.

Further, teachers' perceptions and expectations impact the way instruction is enacted in the classroom.[22] Teachers hold pro-white explicit and implicit racial biases at rates similar to that of the population at large,[23] which may play a role in how materials are used. As the mathematics education scholar, Dr. Laurie Rubel writes: "Teaching for understanding demands that teachers view their students as possessing the

prerequisite mathematical skills, literacy abilities, and problem-solving dispositions, a direct challenge to prevalent constructions of Black and Latino(a) youth."[24] Only through active efforts to notice and counter bias can educators enact equitable instruction.

Finally, educators must examine their identities as learners and doers of mathematics in service of enacting equitable instruction. As Stigler and Hiebert have noted, "teaching is a cultural activity."[25] The experiences teachers of mathematics orchestrate are shaped by their own experiences as learners of mathematics. What constitutes mathematical proficiency, what math instruction should look and sound like, what it looks like when students do math; all of these are linked to individuals' own experiences as learners. And, in fact, in the United States, many of these experiences contain the regrettable features identified above: rote learning, lack of coherence, and needless repetition. Critiquing the system means acknowledging ourselves as products of the system. Taking time to understand and unpack mathematics identities, including reflection on our learning experiences, can help educators forge a new, equitable vision.

Supportive and Culturally Responsive Adaptations

In addition to examining bias, racism, and identity in relation to instruction, successful teachers adapt aligned materials to orchestrate effective learning environments. Increasingly, research shows that learning is context-dependent, driven by culture, and involves students' peer-to-peer social interactions.[26] In fact, learning experiences are effective when they respond to and build on students' preconceptions,[27] experiences, and cultural funds of knowledge.[28] The implications for curricular adaptations are clear. Teachers must know and plan to activate the assets and prior knowledge their students bring to the classroom. They must choose the right opportunities for productive student discourse and know the best way to orchestrate it. They must consider their students' interests and passions and connect these to new learning. This may look like posing additional questions, rewording or resequencing tasks, adjusting the mode of instructional delivery, or other adaptations. A lesson plan may be a series of student tasks on paper; an educator brings it to life by ensuring there are opportunities for students to talk about mathematics, discovering and activating students' prior knowledge of the topic, and making the experience joyful for students.

Further, educators must enact aligned materials in ways that align with theories of culturally responsive and relevant teaching. Dr. Gloria Ladson-Billings' seminal framework is insightful here: not only must instruction hold high expectations for students, but it must also support students' cultural identities and afford opportunities for students to critique inequities.[29] Aligned mathematics curricula are consistently focused, coherent, and rigorous but vary in their attention to the tenets of culturally responsive and relevant teaching. Thus, teacher adaptations play an essential role in ensuring, among other things, that students are given opportunities:

- For reciprocal teaching and other communal and collective learning activities
- To do mathematics in ways that equip students to expose inequities
- To understand the mathematics used in their local communities and histories

Finally, through instruction, equity requires effective supports for students who may have unfinished instruction from prior grades. As defined in UnboundEd's paper, *Equitable ELA Instruction: Immersing Students in Grade-Level Reading & Thinking*, "Supports are adaptations that allow access to the day's grade-level instruction." While aligned materials will have some supports embedded, teachers will likely need to tailor these further to meet the needs of their students. Other terms related to support are defined below:

What are modifications?

Modifications are adaptations that change the learning goal and/or lower the level of challenge for students. Modifications shou d be avoided, unless required by a student's individual education plan (IEP).

- Differentiation is merely a support when implemented as designed. As such, it provides access to the day's grade-level instruction and does not change the goal of students' learning.
- Scaffolds are gradually removed supports that allow students to demonstrate increasingly independent proficiency with grade-level instruction.
- Intervention (addressed in the next section) is a set of steps targeting students' specific, identified needs and unfinished learning. Educators apply intervention when students are not reaching success, despite supports.

Modifications are adaptations that change the learning goal and/or lower the level of challenge for students. Avoid modifications unless required by a student's individual education plan (IEP).

To better understand what enacting equitable math instruction looks like, including the role of materials, mindsets, and adaptations, let's consider two students, Ava and Jayden. Both of their teachers use a standards-aligned set of instructional materials.

Ava

Ava is a sixth-grader in a large urban district; like most students in her class, she brings energy and a wealth of knowledge and experience to school every day. Also, like most of her classmates, she sometimes has difficulty remembering how o multiply and divide whole numbers and finds fractions and decimals confusing. Ava's teacher, Mr. Green, knows his students struggle with prerequisite knowledge and skills, so he decides to adapt the unit rate lesson he is about to teach. As written in the curriculum, this lesson begins with a story problem that involves dividing to find the cost of mowing a lawn, which ends up being a decimal; later, students solve unit rate problems independently, including several examples that involve decimals and fractions. Mr. Green adapts the lesson to spend the first half of the class period r viewing whole number multiplication; Ava and her classmates recite times table entries and then complete two timed multiplication "sprint" drills. Mr. Green then models solving the lawn-mowing problem but adapts it so the answer is a whole number. He models two more problems that also involve only whole numbers, thinking out loud. For

the last fi e minutes of the class period, Ava has opportunities to solve one whole-number unit rate problem independently

Jayden

Jayden is in the class next door. Jayden's teacher, Ms. Gomez, has reflected deeply on what Jayden and his peers know and bring to the classroom, as well as what they need to access grade-level instruction. As a result, for homework the day before the rate lesson, she asks Jayden and his classmates to bring coupons from a local supermarket to school in preparation for the unit rate lesson. In class the following day, Ms. Gomez implements her version of the unit rate lesson. She spends five minutes reviewing multiplication facts through an oral drill; she listens to each student and notes who still needs support in this area. Then, instead of using the lawn-mowing example from the curriculum, she chooses one student to share what they think is a good deal from their supermarket flyer and poses a unit rate problem to the class, based on the student's example. Jayden and his partner work to solve it together before Ms. Gomez opens the problem up for discussion with the whole class. Ms. Gomez then gives more time for students to answer another unit rate question about their supermarket flyer and then share it with their partner. Ms. Gomez notes who may need additional support with the concept of unit rate and provides calculators for some students who have difficulty with decimals computation. For the last 20 minutes of class, students solve the unit rate problems from the aligned curriculum with a partner, while Ms. Gomez offers explicit instruction on problem-solving with unit rates to a small group of students.

These two examples highlight the different ways teachers may enact instruction from the same set of aligned curricular materials. In the case of Jayden, Ms. Gomez enacted equitable instruction in several ways:

- Ensuring all students had an opportunity to do mathematics as described by the grade-level lesson goal
- Building opportunities for students to talk with each other about the mathematics they are learning
- Building interest and drawing on students' experience through the use of an artifact from the local community
- Offering calculators strategically to allow students to focus on problem-solving and conceptual development
- Identifying struggling students through formative assessment and working in a small group with them on the grade-level objective

In contrast, Mr. Green minimized opportunities for doing mathematics, focused the lesson on prerequisite skill acquisition, and did not consider his students' funds of knowledge related to unit rates.

Adopting aligned materials gave Ms. Gomez time and energy to focus on adapting instruction to support Jayden and the other students in the class with grade-level instruction that was meaningful, engaging, and affirming. In some ca es, students may still struggle, leading to the need for intervention.

3. Provide targeted intervention in addition to and in service of grade-level learning.

While we assert that adopting aligned materials and enacting instruction that is grade-level, engaging, affirming, and meaningful will go a long way toward improved opportunities for learning mathematics, there may be times when students, having received significant support in the core instructional block, require additional intervention to succeed.

With schooling disrupted by the COVID-19 pandemic, there will undoubtedly be increased focus on intervention, and it will be critical to adhere to equitable practices in this area. Placement in intervention should be based on assessment, and intervention instruction should be explicit and systematic;[30] it should emphasize the use of concrete and visual representations and include targeted fluency practice, as well as deliberate instruction with word problems.[31]

The primary objective of intervention should be to maximize opportunities to learn grade-level knowledge and skills. Educators should align learning outcomes to the most relevant prerequisites for grade-level learning and present content to students within the context of grade-level learning whenever possible. This contrasts with approaches that focus heavily on procedural fluency or personalized, linear paths through content from prior grades. These methods do not translate logically to increased grade-level learning; they also involve retread of content from previous grades in ways that may be unmotivating and counterproductive.

Equitable intervention centers the primary objective of maximizing opportunities to learn grade-level knowledge and skills. It reinforces an asset mindset about students by focusing on ways to do grade-level work and encourages effective instructional practice during the core instructional block.

What does this approach look like? Let's return to Ava and Jayden.

Ava

Because she is often bored in math class and doesn't complete some assignments, Ava has received an extra intervention block in math since the beginning of the school year. She and some of her classmates use a computer-based math program during this time. After taking an initial diagnostic test, the program places Ava at a third-grade level. Each day that she receives intervention, she is provided with guided examples and practice problems from the third-grade standards. So far this year, she has practiced solving whole number multiplication and division problems, computing the areas of rectangles, and recently has begun work with fractions. On the day before the lesson on unit

rates, Ava has a problem set that focuses on comparing fractions using a number line. She is mostly bored but completes the problems because the program has entertaining graphics and gameplay.

Jayden

Jayden receives an extra intervention period during instruction on unit rates after his teacher analyzes a recent interim assessment. His intervention teacher knows Jayden and others in a small group identied for this unit would benefit from support with multiplication and work with fractions and decimals. Every day that Jayden receives intervention, he spends the first ten minutes developing fluency with whole number multiplication and division through examples, oral drills, and timed exercises. On the day before the lesson on unit rates, Jayden's intervention teacher explicitly teaches strategies for dividing non-whole numbers, using visual models to explain them. She then uses multiplication and division within unit rate problems as an opportunity to teach grade-level concepts while also reinforcing strategies for these operations. Jayden and his classmates have time to practice with a mix of contextual unit rate problems and simple decimal division exercises.

Jayden's experience with intervention was equitable because:

- He was placed in a temporary intervention group based on a recent assessment.
- The intervention was tied to a skill identified from the assessment.
- The intervention featured fluency practice and worked with visual models to build conceptual understanding.
- Instruction on the intervention skill was embedded within grade-level work.
- The intervention was coordinated with and designed to lead to success in the core instructional block.

It is important to note that intervention should only occur when students have diagnosed disabilities, have not yet developed proficiency with certain key skills necessary for the grade-level, or have yet to respond to strategies and supports used in the main instruction block. It should not happen because of students' behavior, proficiency in other subjects, ineffective instruction in the main mathematics block, or general perceptions of individual students or groups. Notably, intervention also requires collaboration and coordination among main block teachers, intervention teachers, coaches, and school leaders, which leads to positive student effects.

The power of supplemental instruction is its ability to enhance and extend students' success with the core, grade-level sequence of learning. Intervention must be viewed as another tool for maximizing students' exposure to GLEAM™ instruction that is grade-level, engaging, affirming, and meaningful.

Mathematics can bring us joy, beauty, freedom, and independence. And yet, there is much work to do to offer this rich vision of the subject to all students. Let's do better by adopting aligned materials, enacting them in engaging, affirming, and meaningful ways while coordinating equitable intervention programs. By working together with a common purpose, we can bring a more equitable mathematics vision to life.

Create a vision for equitable mathematics instruction.

The actions of teachers, coaches, and administrators must be coherently coordinated to bring a vision of equitable learning to life.

Educators at all levels must see and enact the vision of equitable mathematics instruction with a growth mindset and a learning orientation. Everyone must encourage and engage in courageous conversations about racism and bias that keep equitable mathematics instruction at the forefront.

System leaders must engage others across the organization to create a shared vision of equitable mathematics instruction with an aligned curriculum, supports that maximize persistence, and interventions that serve the aligned curriculum.

System leaders and school leaders must ensure schedules include dedicated intervention time and provide supplemental and intervention materials that work in service of the standards-aligned curriculum's content, concepts, and skills. That is, intervention materials should be aligned to the grade-level objectives of the standards-aligned curriculum.

School leaders and instructional leaders must develop a deep understanding of what the standards demand and what equitable mathematics instruction looks like in action. They must ensure educators' learning, planning, and practices are anchored in the standards-aligned curriculum; without this, equitable student access to the goals and objectives of the curriculum are compromised. They must develop a lens and the tools for surfacing inequitable practices (e.g., modifications versus supports; using core class time for intervention; interventions that aren't aligned to the core grade-level instruction). Using these lenses and tools, they must coach toward practices that maximize the amount of time students spend (supported as needed) engaging with grade-level tasks.

Instructional leaders and teachers must use coaching conversations and collaborative conversations with grade-level peers and interventionists to improve the planning and delivery of instruction, instructional supports, and interventions needed to advance students' abilities to engage and persist with grade-level learning.

Teachers must marry the critical work of understanding, internalizing, and preparing aligned lessons with reflection on their role within our biased systems to identify barriers to offering the grade-level instruction, supports, and interventions that cause change.

Educators at all levels must learn to recognize the connection between their instructional moves and their students' access to engaging instruction, the disruption of racism in our schools, and the liberation that comes with doing mathematics.

Learn More

We invite you to join us at the UnboundEd Standards Institute or Virtual Summit to engage with educators across the country on the intersection of standards, content, aligned curriculum, and equity.

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Endnotes

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