

Fostering STEM Aspirations

for Students of Color in Middle School

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MATH AND SCIENCE ARE FOR EVERYONE. But unfortunately, many students, and especially Black and Latino students, don't receive that message or the resources needed to make it a reality. Even early on, many students are told they are not a "math person," or a "science person;" as such, Black and Latino students have long been denied access to advanced coursework, from elementary through high school. In particular, middle school students of color and students from low-income backgrounds are not being given equitable access to rigorous and empowering courses, including advanced Science, Technology, Engineering, and Math (STEM) courses, which set students on college-ready pathways.

In this brief, we will explain the importance of giving middle schoolers access to STEM coursework as part of their social, emotional, and academic development, as well as give five recommendations to state leaders so that they can ensure that all middle school students have access to high-quality, rigorous, relevant math and science courses, and that all schools have equitable policies in place for enrolling more Black and Latino students in advanced coursework.

Why rigorous STEM in middle school?

Middle school is a crucial time for students to develop career aspirations, and specifically, middle school students' [identification](#) with STEM-related careers. More access to rigorous and advanced STEM coursework in middle school is essential to equip students with 21st century skills like creativity, critical thinking, and technology literacy, while preparing students to be future-ready for jobs that do not even exist yet. Access to advanced coursework and rigorous STEM experiences in middle school can also set students up for success by earning college credits in high school so they can graduate quicker and take on less student debt.

What's more, Black and Latino students are successful in advanced coursework when they have the opportunity. Ed Trust's 2022 report, [Shut Out: Why Black and Latino Students are Under-Enrolled in AP STEM Courses](#), found, however, that Black and Latino students and students from low-income backgrounds are denied access to AP STEM opportunities such as AP Biology, AP Physics, and AP Chemistry, despite voicing interest in going to college and pursuing a career in a STEM field. The under-enrollment of Black and Latino students and students from low-income backgrounds in AP STEM courses is linked to resource inequities, educator bias, and racialized tracking, and all these issues begin [before high school](#).

For example, many Black and Latino middle school students are not exposed to positive and engaging STEM experiences and attend schools without the resources needed to offer advanced courses. These factors contribute to inexcusable opportunity gaps seen through [National Assessment of Educational Progress](#) (NAEP) data, which shows that only 16% of Black students and 21% of Latino students are proficient in mathematics by eighth grade, compared to 57% of Asian students and 38% of White students.

We are focused on STEM because STEM careers are [expected](#) to grow at twice the rate of other jobs in the next decade. Yet Black and Latino workers, as well as women, [remain](#) under-represented in STEM careers. If these inequities continue, the U.S. is unlikely to have a diverse and representative STEM workforce and all the workers it needs. Increasing the number of people of color in STEM careers must start by giving students the opportunity to engage in rigorous and engaging STEM courses in K-12 classrooms.

Early engagement is key, yet, according to a recent report, 50% of all students say they are not engaged in what they are learning most of the time. Great teaching unleashes students’ innate desire to learn. Unfortunately, many Black and Latino students are assigned novice [teachers](#), who may need more experience and support to successfully teach rigorous math content. Additionally, schools need more educators of color who can recognize and reflect the true potential of students of similar race and backgrounds. In some schools, there is a culture of low expectations of what students can achieve — and students of color are affected disproportionately.

Considering that young adolescence is a significant stage in identity development, it is crucial that schools provide resources and experiences that foster and strengthen strong science and math identities in middle school, so that students, especially students of color and students from low-income backgrounds, know they belong and will be encouraged to thrive. STEM identity formation is a predictor of both middle school students’ [academic learning](#) and [identification](#) with STEM-related careers. The higher the sense of belonging, the [stronger](#) the academic outcomes. Every child deserves the [right combination of resources](#) to unlock their full potential, and that starts with positive and inviting school climates and curriculum for all students, particularly in classes that often feel unwelcoming.

Why does this matter? Because middle school opportunities can set students up for a rigorous sequence of core courses in high school, such as four years of English Language Arts, four years of mathematics, and at least three years of science. Such course-taking sequences are among the [strongest](#) predictors of success in college.

DEFINING RIGOROUS AND ACCELERATED COURSEWORK

Definition	Description
Rigorous	<p>Rigorous classes are high quality, intellectually challenging, and prepare all students for college prep pathways in high school. This includes culturally relevant and connected experiences that foster a love of and confidence in math and science.</p> <p>See these resources from The Education Trust-West, WestEd, and Just Equations for tools on rigorous, equitable middle and high school math pathways.</p>
Accelerated or advanced coursework	<p>Advanced coursework provides students with opportunities to learn at a faster pace than the traditional course sequence, with additional challenges and expectations.</p> <p>Advanced courses in middle school can also put students on a pathway to earn college credit in high school.</p> <ul style="list-style-type: none"> Middle school students in an advanced math pathway would take Algebra I in eighth (or even seventh) grade, while those on a typical course sequence would take the course in high school.

If Black and Latino students had a fair opportunity to participate in eighth grade algebra nationwide,

SCHOOLS WOULD ENROLL AN ESTIMATED

43,000 **BLACK STUDENTS**

and

60,000 **LATINO STUDENTS**

IN EIGHTH GRADE ALGEBRA COURSES

Why is equitable enrollment in middle school Algebra important?

Black and Latino students, as well as students from low-income backgrounds, are under-represented in middle school algebra. Disparities in access to Algebra I are more likely to be found in schools that are [majority](#) Black and/or Latino. Even when students of color are in middle schools that offer Algebra I and have available seats, they are still learning in an inequitable system. Research finds that teachers in predominately Black schools [cover](#) significantly less algebra material than their peers in schools that are mostly White or are racially diverse. This means that middle school students who attended predominantly Black schools may get an A in Algebra I, but show up to high school having mastered less content than their peers from mostly White schools.

Algebra I is the [gateway](#) to the college-preparatory calculus pathway in high school, which has historically been required for students pursuing STEM careers (although that is [changing](#), with more options for students to take such as statistics and data science). At the same time, Algebra I is also a gatekeeper that prevents some students from accessing future educational opportunities, and specifically STEM opportunities.

Students who take algebra in middle school have more opportunities to excel in advanced math and science in high school, as most advanced math trajectories begin in middle school. And increased access to advanced math courses in high school is associated with [college readiness](#), [majoring in STEM in college](#), [having STEM career interests](#), and [future increased earnings](#). Conversely, students who fail algebra (which most students take in ninth grade) are far [less likely to graduate high school](#) on time and attend a four-year college.

ONLY 1 IN 4 **science and engineering**

BACHELOR'S DEGREES IN 2020

were awarded to Black and Latino students

ACCORDING TO THE NATIONAL SCIENCE FOUNDATION

What is happening?

Inequities start early and continue through middle school. Gaps grow, especially in eighth grade, when Algebra I acts a gatekeeper to an accelerated path in high school that puts students on track for college and future STEM coursework. And when courses are assigned through a subjective approach that relies on an educator's recommendation, eager and ready Black and Latino students are [less likely](#) to be placed into advanced courses than their White and Asian peers.

[One in four](#) students will be given access to algebra in middle school. This means that most students, especially Black and Latino students, are on a traditional course sequence, which may limit their opportunities for advanced STEM coursework in high school and even college. These students are denied benefits that can come with accelerated coursework in middle school, such as improved [college readiness and aspirations](#) and [greater access to advanced courses in high school](#), which increases [access to college](#) and future increased earnings. Instead, many middle school students of color may be denied a seat in an algebra course in middle school, even though they are fully capable of excelling in the course.

In [New York](#), Earth Science in middle school is on an advanced pathway that can help enable students to be ready for future advanced STEM courses. However, the majority of Black and Latino students and students from low-income backgrounds attend middle schools that do not offer Earth Science. Even at schools that do offer the course, Black and Latino students and students from low-income backgrounds are less likely to be enrolled.

Why is this happening?

There are numerous systemic policies and practices in place that deny Black and Latino students access to advanced coursework in middle school:

- **Resource inequities** in schools can result in a lack of course offerings
 - Schools that serve a predominantly Black, Latino, or low-income student body have [fewer seats](#) available in advanced courses, [receive less state and local revenue](#), and struggle with staffing, particularly [experienced](#) math and science teachers.
 - [Inequities](#) early on, such as [inadequate](#) early childhood educational opportunities, deny Black, Latino, and low-income students a strong start in kindergarten, and under-resourced schools are less likely to offer early interventions to help students catch up.
- **Subjective placement policies** reduce the likelihood that students of color and students from low-income backgrounds will be placed into advanced courses, including Algebra I
 - Teachers' and school counselors' implicit or explicit biases may prevent them from believing [students of color can succeed](#) in the course. Schools or districts may also **fail to provide parents with accessible information** on the [importance of algebra](#) in middle school and identification and enrollment processes.
- Within the classroom, **educator bias** and an **unrepresentative curriculum** can mean that Black and Latino students struggle to feel a sense of belonging
 - Educator bias, along with students' experiences of stereotypes in school and society, leads to [racialized](#)

[STEM](#) classrooms and education, where students of color have different learning opportunities and experiences than White students. When students experience the math or science classroom as unwelcoming or exclusionary to their identities, or encounter passive and decontextualized forms of STEM in school, they can be discouraged to enter STEM spaces because they don't have a [sense of belonging](#) in mathematics, or may struggle to envision a future in STEM.

- Instead, high-quality, [culturally sustaining](#), student-centered [STEM curricula](#) that connects students' lived identities with the content can help students feel they belong in the classroom, acquire [deeper](#) understandings of STEM concepts, and develop a positive STEM identity.
- **A lack of access to educators from diverse backgrounds** may perpetuate exclusion for students of color
 - Students of color often [thrive](#) socially and academically in classrooms where teachers share their cultural background. And teacher behaviors and interactions with students, instructional practices, and curriculum can instill further engagement and a sense of [belonging](#) in STEM among students of color, students from low-income backgrounds, students with disabilities, and girls. However, middle schools with larger shares of White teachers tend to have increased [disparities](#) in access to algebra. Teachers who do not connect with students and their communities may employ a deficit view of students that leads to low expectations, fewer [student-focused strategies](#), and [simpler tasks](#), rather than challenging students to engage in rigorous science and math.
 - Teachers of color are [more likely](#) to create a positive school climate that [supports](#) students of color in taking advanced courses by serving as a role model and [reaching out](#) to students of color to encourage them to enroll in advanced courses. Teachers of color can also create [identity-affirming environments](#) by demonstrating a successful person of color who has mastered the content being taught, which can help students of color see themselves reflected in the classroom, and also feel less of a burden representing an entire group of students.



5 State Policy Recommendations

All middle school students should have access to high-quality, rigorous, relevant math and science courses, and all schools should have equitable policies in place for enrolling students in advanced coursework. To get more students in advanced courses, there is not just one barrier but many things at once. To address the entire system of learning and increase access to early opportunities for advanced coursework, states can take the following five actions:

1. Collect and publicly report on disaggregated data on enrollment and seats available in advanced courses in middle school

- See the [Illinois Report Card](#), which displays the percentage of eighth graders passing Algebra I, and the [Kentucky Department of Education School Report Card](#) dashboard, which details gifted and talented participation by grade broken down by race, gender, socioeconomic status, and other characteristics

2. Change identification and enrollment policies to enroll more students of color in advanced coursework, such as automatic enrollment policies with an opt-out option and the use of multiple measures to identify more students for advanced coursework opportunities

- In 2017, investigative reporting by the [News & Observer](#) in Raleigh, North Carolina, [found that students from low-income backgrounds](#) were being placed in advanced coursework at lower rates than more affluent peers with the same levels of achievement. In response, North Carolina enacted an automatic enrollment [policy](#) that guarantees all students who score at the highest level on their end-of-grade math test are placed into an advanced learning opportunity (grades 3-5) or an advanced math course (sixth grade and above) during the following school year. In [2022-23](#), 92% of North Carolina students in grades 6 and above who scored at the highest level on their end-of-grade math test were placed in an advanced math course
- The [Math Placement Act](#) of 2015 required California school districts with eighth grades and/or ninth grades to develop, establish, and implement fair, objective and transparent mathematics placement policies that consider multiple objective measures as the basis for placement and permit multiple checkpoints to assess placement accuracy and student progress, especially at the start of the academic year
- Tools like the Equal Opportunity Schools' [Student Insight Card](#) include data about students' interests, aspirations, and strengths, and schools can factor in this data to cast a wider net and include more students in accelerated coursework

3. Adopt high-quality instructional materials and provide ongoing professional development and coaching for teachers to use math instructional practices that are effective and engaging for all students

- Colorado required all districts that applied for an [ESSER instructional materials grant](#) to select from a list of instructional materials deemed high-quality by [Ed Reports](#)
- Louisiana has invested heavily in [high-quality instructional materials](#) and professional learning in math and science, among other subjects

4. Require districts and/or schools to notify families early and often about advanced coursework opportunities available in the school and district, the benefits of enrolling in those courses, and the process around how to enroll, in the family's home language

- In [2021](#), Connecticut revised its statutes related to advanced coursework to emphasize partnering with families to share information about opportunities for their students. Starting in sixth grade, districts must develop an individualized Student Success Plan (SSP) for each student that provides support in setting goals for academic, career, social, emotional, and physical development that meet rigorous high school and postsecondary expectations. The SSP emphasizes partnership with families and caregivers to ensure that everyone is fully aware of all the benefits of taking advanced coursework. Communication is ongoing and materials are provided in multiple languages with translators available during large, small, and personal information sessions

5. Invest in infrastructure such as course enrollment policies, school counselors, culturally sustaining curriculum, and professional development, that supports more access to and belongingness in advanced courses in middle schools in high-needs school districts

- New York's [equitable course access guidance](#) shares best practices for educators and district leaders, which includes course sequences in earlier grades that are designed to make later advanced coursework possible; school counselors are trained to engage with families and students of all backgrounds; and student-centered supports in advanced coursework such as tutoring and access to technology are available



PROMISING PRACTICES: INCREASING ACCESS TO RIGOROUS MATH IN CENTRAL TEXAS

There is no single solution to prepare students for advanced coursework and ensure their success. To combat existing inequities, districts must adopt a comprehensive approach.

For example, while analyzing data from the class of 2009, [E3 Alliance](#), a data-driven education collaborative in Central Texas, found that just 1 out of 3 Black students and about half of the Latino students in Central Texas who scored at the highest level on the fifth grade math exam (STAAR) in 2014 had completed algebra by eighth grade, despite having clearly demonstrated an early readiness for rigorous math.

E3 convened a Pathways of Promise Steering Committee to review research and promising practices for providing equitable access and instruction in math for all students, and their findings prompted significant policy changes. By working with school districts to put into practice recommendations such as promoting the advantages of advanced math, automatically enrolling students in advanced courses, and offering training for teachers, there was a rapid improvement. In 2021, nearly 80% of Black and Latino students in Central Texas who scored at the highest level on the fifth grade state exam in 2017 were enrolled in eighth grade Algebra I.

By implementing an opt-out policy and more equitable, consistent student advising for middle school accelerated math, [participation](#) in eighth grade Algebra I for high-performing Latino students increased by 20 percentage points, and for high-performing Black students, participation increased by over 30 percentage points.

Districts must ensure that enrollment policies, district scheduling, and course sequencing pathways prepare all students to enroll and succeed in advanced courses in middle school.

For district leaders interested in implementing more on-ramps to rigorous and accelerated coursework, see the Alliance for Resource Equity's guidebook on [Empowering Rigorous Content](#).



HOW FEDERAL FUNDING CAN HELP ENCOURAGE ENROLLMENT IN ADVANCED COURSEWORK

The federal government can provide funding and guidance to states and local education agencies to ensure that students of color, English learners, and students from low-income backgrounds can access and succeed in advanced courses. Congress can also encourage states to expand automatic enrollment. For example, the [Advanced Coursework Equity Act](#), filed in 2020, would provide resources to states and districts to close opportunity gaps by implementing the practices and policies that are proven to work, including automatic enrollment policies, open enrollment, and universal screening; preparing more educators to teach advanced courses; offering a greater selection of courses; and covering course material and exam fees for students from low-income backgrounds.

STEM shouldn't be a gatekeeper, but rather a door opener. For all students to feel welcome in the classroom and become college and career ready, they must have access to equitable, rigorous, and advanced opportunities in STEM courses. Note that depending on the state, algebra in middle school may require compressing seventh and eighth grade standards, which can potentially compromise students' foundational skills without adequate support and teacher preparation. And when schools offer accelerated tracks, it is essential that courses do not skip, but compress content, and that there is equitable access, support, and curricular cohesion across all grade levels, so students of color and students from low-income backgrounds receive high-quality, culturally, and linguistically relevant curriculum and instruction.

What's more, the impact of the pandemic has meant that students and families continue to experience unfinished learning and mental health crises, while schools and districts grapple with a devastating slide in math proficiency across the country — especially in seventh and eighth grade math. Curricula that is relevant to students' lives and communities, high expectations for all students, and strong relationships with teachers and school staff can help strengthen engagement and boost positive self-perceptions as learners. School and district leaders have an opportunity to support the well-being of all students, while giving more students the chance to feel belonging in their classrooms of today, so they have more opportunities in their visions for tomorrow.

To see if your state prioritizes professional development for educators to develop a combination of skills and mindsets needed to equitably support students, see Ed Trust's 50-state scan: "[Is Your State Prioritizing Students' Social, Emotional, and Academic Development?](#)"

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