EdResearch for Action

EVIDENCE-BASED PRACTICES FOR ALGEBRA I ACCESS, PLACEMENT, AND SUCCESS

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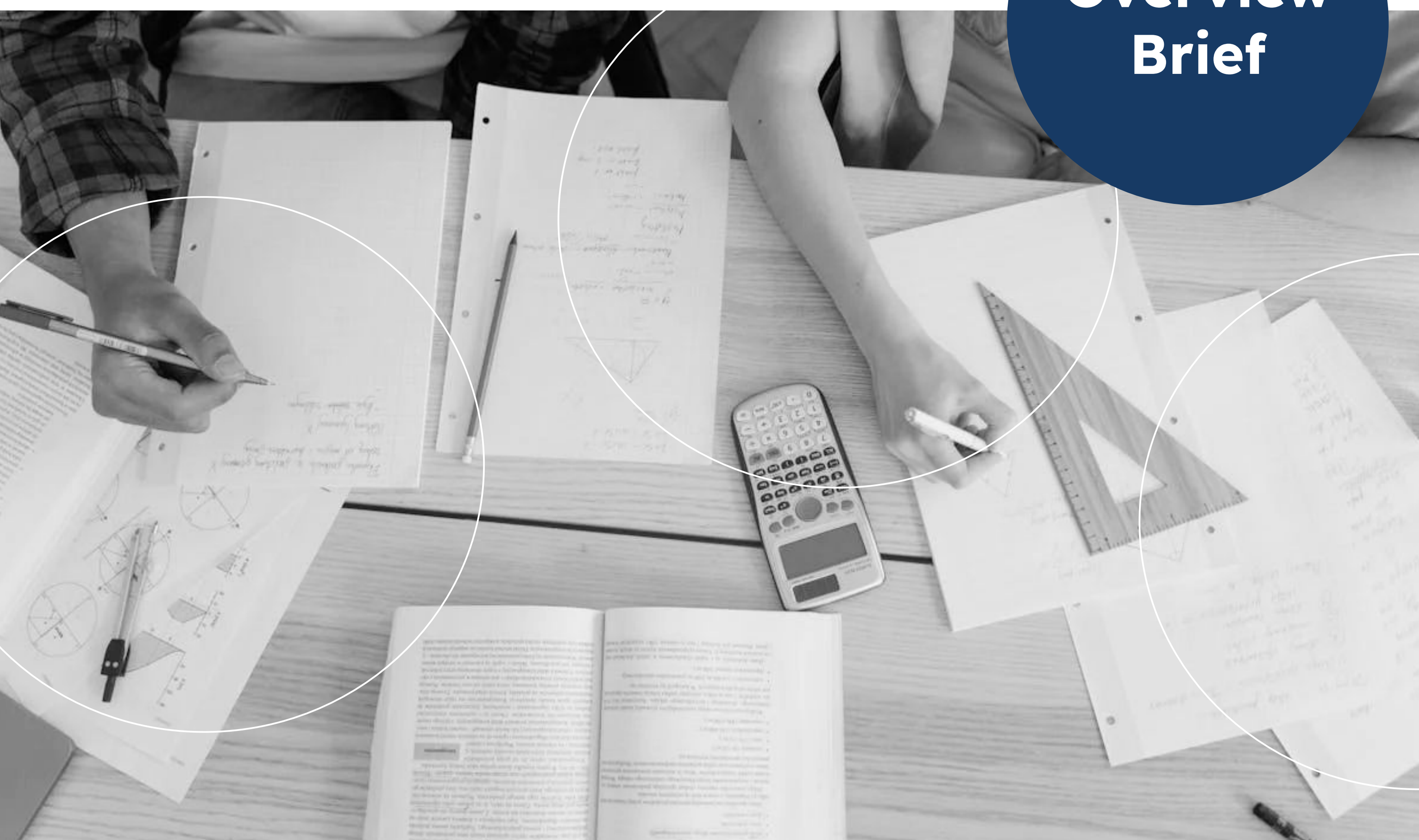
Overview Brief



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SUMMARY OF EVIDENCE-BASED PRACTICES

ACCESS AND ENROLLMENT: When should students take Algebra I, and how should readiness be assessed?

- Long-term academic success is higher when students are enrolled in Algebra I based on academic proficiency rather than grade level.
- Middle school students who demonstrate readiness should have access to Algebra I. Training and incentives for Algebra I teachers, along with virtual course options for schools that lack in-person offerings, can help expand availability.
- Placement decisions based on a combination of test scores, rather than subjective referrals or one test score, improve participation and achievement in Algebra I, especially for historically underserved students.
- Auto-enrollment policies increase participation and completion rates in advanced math courses, particularly among underrepresented students, by reducing barriers and signaling that they belong in accelerated pathways.
- While there is no universally optimal threshold for Algebra I placement, prior test scores and predictive tools can accurately estimate student readiness.

GROUPING: How should schools group students in Algebra I classrooms given differences in preparation and learning needs?

- Placement decisions that are based on students' current learning needs, made separately by subject, and revisited regularly, create flexibility and strong academic outcomes. In contrast, rigid tracking systems that start in early grades reinforce existing opportunity gaps and have negative impacts.
- Similar-proficiency (i.e., tracked) classrooms enable more targeted instruction and can benefit both middle- and high-achieving students. But they also tend to widen achievement gaps, increase segregation, and can create negative self-perceptions for students in lower-achieving class sections.
- Mixed-proficiency (i.e., detracked) classrooms offer all students access to rigorous coursework and more inclusive learning environments, but risk discouraging lower-achieving students and slowing progress for high-achieving students.
- Effectively supporting a wide range of academic proficiency levels in one classroom requires teachers to have advanced skills, sufficient planning time, and access to strong instructional resources.

SUPPORTS: What instructional supports help students succeed in Algebra I, especially those who start behind?

- Extended or supplementary Algebra I instruction during the school day has been shown to improve both short-term achievement and long-term educational outcomes.
- Tutoring, especially when delivered in small groups, multiple times per week, and during the school day, is one of the most effective academic interventions.
- Online platforms and GenAI tools offer the potential for personalized math instruction, but research on their effectiveness is still emerging.
- Summer bridge programs can help students build the skills and confidence needed for success in Algebra I, though evidence of their effectiveness is limited.

The EdResearch for Action Overview Series summarizes the research on key topics to provide K-12 education decision makers and advocates with an evidence base to ground discussions about how to best serve students. Authors – leading experts from across the field of education research – are charged with highlighting key findings from research that provide concrete, strategic insight on persistent challenges sourced from district and state leaders.

CENTRAL QUESTION: What evidence-based policies and practices promote Algebra I access, appropriate student placement, and improved achievement?

*This research brief focuses on **school- and district-level policy decisions that shape Algebra I pathways and outcomes**, such as when students take the course, how they're placed, and what supports promote success. While strong teaching and instructional leadership are essential for all Algebra classrooms, those topics are beyond the scope of this brief.*

The brief refers to Algebra I as a formal course, typically offered in middle or high school, rather than a set of mathematical concepts. Algebra I is the first course of the typical American sequence that confers math credit towards high school graduation.

BREAKING DOWN THE ISSUE

Why is Algebra I a focal point for policy and practice?

Algebra I is a key gatekeeper to advanced coursework, college access, and STEM careers, but it is also one of the most failed high school courses.

- Early (8th grade) Algebra I enrollment is linked to higher high school math achievement and completion of advanced coursework, which increases the likelihood of four-year college enrollment, pursuing a STEM major, and better long-term economic outcomes, especially for historically underserved students.
- Many families believe that competitive colleges expect students to complete five high school math courses ending in Calculus, which requires Algebra I (or an equivalent course such as Integrated Mathematics[1]) before 9th grade. Calculus is rarely a formal requirement for college admissions, but many admissions officers view it as a strong signal of college readiness.
- Students who are not proficient in Algebra I by the end of 9th grade are less likely to meet college admissions requirements or graduate from high school on time. Yet, Algebra I failure rates exceed those of other 9th-grade subjects.
- For decades, these factors have positioned Algebra I at the center of policy debates about equitable access and excellence in secondary math.

[1] Following the roll-out of the Common Core, which was agnostic between the traditional high school sequence (i.e., Algebra, Geometry, Algebra II) and an alternative (i.e., algebra, geometry, and statistics content is taught in every year of a three course sequence), Integrated Math has become more common in several states. Much of the insights in this brief apply to the first course in this sequence (e.g., Integrated Math I).

How big are gaps in access and readiness, and what factors best explain these gaps?

Students from historically underserved groups are less likely to enroll and succeed in Algebra I by 8th grade.

- In 2021, 27% of white 8th graders in the U.S. were enrolled in Algebra I, compared to just 16% of Black 8th graders, a gap that has widened slightly over the past 30 years.
- High-achieving students, especially those from low-income backgrounds or who are English language learners, are often absent from accelerated math pathways. A study in Virginia found that 25% of students who scored "advanced proficient" in grade 5 did not take the accelerated math pathway. The rates were even higher for low-income students (37%) and English learners (42%).
- Algebra I pass rates reveal clear racial disparities: in 8th grade, 89% of Asian and 87% of White students pass, compared to 81% of Hispanic and 78% of Black students.
- Historically underserved students are disproportionately represented among those still trying to pass Algebra I in the later years of high school. Among 11th and 12th-graders still taking Algebra I, 57% are Black or Hispanic.

Differences in when students take Algebra I are driven by four key factors:

1. **Readiness Gaps:** Educational opportunity in early-years math is unequal, and students enter middle school with varying levels of math proficiency. This is reflected in Algebra I placement when test scores are used to determine assignment. Post-pandemic learning loss increased these gaps, as students who were already struggling experienced the sharpest declines.
2. **Bias in Placement:** Teacher or counselor recommendations can be influenced by implicit bias. When recommendations are used for placement, fewer Black, Hispanic, low-income, and first-generation students enroll in Algebra I early, even when they are qualified. A 2023–24 RAND survey found that wealthier schools were more likely to consider teacher referrals and parent requests in Algebra I placement decisions.
3. **Information and Preferences:** Students' willingness to enroll in Algebra I early often depends on access to role models, encouragement, and reliable information about high school and college pathways. Families with more resources are often better positioned to navigate these decisions and advocate for accelerated placement. Without efforts to proactively inform and support all students and families, increasing parent involvement in course enrollment is likely to widen, rather than narrow, opportunity gaps.
4. **Priorities and Resources:** Middle school Algebra I is less available in rural, small, and low-income districts. The 2023–24 RAND survey found that nearly 25% of the highest-poverty schools did not offer Algebra I to 8th graders, compared to just 6% of the wealthiest schools. States and districts also differ in their approach—some prioritize giving more students access, while others focus on ensuring strong pass rates or maintaining a uniform math sequence.

Over the past three decades, policies have shifted from universal to more targeted strategies, aiming to better balance access to and achievement in Algebra I.

- In the 1980s and 1990s, early enrollment in Algebra I was rare; only 15% of 8th graders took the course in 1986. There were no consistent criteria guiding placement decisions, leading to highly variable practices both within and across districts, which reinforced existing disparities in academic opportunity.

- **The "Algebra for All" Movement (2000s):** In the 1990s and 2000s, many states implemented universal 8th-grade Algebra I to expand access. Enrollment increased as a result; by 2011, nearly half of all 8th graders were taking Algebra I or an even more advanced course. However, it also led to higher failure rates, declines in test scores, reduced high school achievement, and long-term challenges for unprepared students. It also created new course-taking disparities, such as increased enrollment in 8th-grade Geometry among already advanced students.
- **Common Core Reforms (2010s):** The Common Core's more rigorous middle school math sequence reduced emphasis on 8th-grade Algebra I. Combined with concerns about racial disparities in Algebra I outcomes, this led many districts, such as San Francisco, to delay Algebra I until 9th grade, which sparked backlash from parents seeking earlier access. As a result, middle school Algebra I enrollment fell to 39% overall (NAEP 2019) and just 26% among public 7th and 8th graders (CRDC 2020–21).
- **Emerging Policies (2020s):** In 2024, only 36% of 8th graders were enrolled in Algebra I or higher. Recent efforts focus on expanding access *and* improving outcomes through strategies like automatic enrollment (which has been rolled out in a small but growing number of states), targeted supports (e.g., tutoring, double-dose Algebra), and personalized learning tools, including GenAI.
- These national trends vary by state. In 2007, enrollment in 8th-grade Algebra I ranged from 21% in North Dakota to 59% in California. Recent shifts reflect different state priorities. For instance, California has returned control to districts while Minnesota maintains its universal early Algebra I policy.

Efforts to expand access to Algebra I have surfaced longstanding tensions around when students should enroll, how they are grouped, and what supports they need to succeed. Three key questions shape the current policy landscape:

- **Access and Enrollment:** When should students take Algebra I, and how should readiness be assessed?
  - Districts face a challenging tradeoff between two important goals: expanding early access to Algebra I, especially in 8th grade, to broaden participation in advanced math opportunities, and ensuring students are academically ready to prevent course failure, disengagement, and long-term setbacks in math achievement. Striking the right balance requires weighing the benefits of early acceleration against the risks of enrolling students before they're prepared.
- **Grouping:** How should schools group students in Algebra I classrooms given differences in preparation and learning needs?
  - Broadly, "tracking" refers to the practice of assigning students to courses based on their perceived proficiency level. In the U.S., tracking typically refers to both:
    1. *Sorting same-grade students into different courses*. For example, in 8th grade, some students are placed in Algebra I, while others are placed in a pre-Algebra or general math course based on prior test scores or teacher recommendations. Very advanced students may even be placed in Geometry. "Automatic enrollment" placement policies track students in this manner.
    2. *Sorting students into different levels within the same course*. For example, all 9th-grade students may take Algebra I, but they are divided into "Honors Algebra," "Standard Algebra," or "Algebra Support" sections based on perceived proficiency. Even though the course name is the same, the expectations, pacing, and rigor often differ significantly between sections.

  - Tracking is widespread, especially in older grades. Nationally, about 25% of 4th graders and 75% of 8th graders attend schools that use tracking.
  - Supporters of tracking argue that it improves learning by targeting instruction to students' individual needs. Opponents argue that tracking reinforces existing inequalities by disproportionately placing historically underserved students into lower-level courses, limiting their access to accelerated content, peer networks, and future academic and career opportunities.
- **Supports:** What instructional supports help students succeed in Algebra I, especially those who start behind?
  - Districts have tried a wide range of strategies to help students succeed in Algebra I, including tutoring, technology tools, extra class periods, and curriculum reforms. But these efforts risk being under-resourced, inconsistently implemented, or disconnected from what research shows is effective.

EVIDENCE-BASED PRACTICES

Decades of research on various Algebra I policies have identified key factors that promote Algebra I access, appropriate student placement, and improved achievement.

ACCESS AND ENROLLMENT: When should students take Algebra I, and how should readiness be assessed?

Long-term academic success is higher when students are enrolled in Algebra I based on academic readiness rather than grade level.

- **Academically-ready students:** Students who are ready for Algebra I in middle school and given access achieve more in math and gain greater long-term opportunities than peers without access
  - 8th graders deemed "algebra-ready" who were offered access to online Algebra I that their rural schools could not otherwise provide demonstrated improved high school math achievement relative to their "algebra-ready" peers who were not offered access to this course.
  - In a Florida district, students scoring in the top 20% on state math tests were assigned to take Algebra I in 7th grade, putting them two years ahead of the traditional math track. Female students who just met the eligibility cut-off were twice as likely to complete a STEM bachelor's degree as those just below the cut-off, closing the gender gap in STEM degree completion.
  - A longitudinal survey suggests that very advanced students benefit from being accelerated into Algebra I in 7th or even 6th grade, though effective early acceleration considers social-emotional readiness.

- **Borderline-ready students:** For borderline-ready students, early access has mixed results.
    - In Wake County, borderline-ready girls and non-low-income students who were accelerated into 8th-grade Algebra were more likely to take advanced math and plan to attend college. However, all male and low-income borderline-ready students exited the accelerated track by 11th grade, ending up where they would have been otherwise.
    - Whether it is sensible for schools to accelerate students with uncertain readiness into early Algebra I depends on whether such students are a large proportion of the student population. The acceleration of *many* borderline students is likely to be disruptive and ineffective. If questions about borderline placement refer to only a small number of students, peer effect benefits can allow districts to err on the side of acceleration.
    - Districts with the capacity to provide supports (e.g., tutoring, double-dose) may also have leeway to err on the side of accelerating students who are borderline.
- **Not academically-ready students:** Students who are not academically ready need significant support to be successful in Algebra I.
    - A series of causal studies evaluating the "Algebra for All" movement found that middle school access increases failure rates and reduces high school math scores for those who are not prepared.
    - For underprepared high school students, taking Algebra I in 9th grade, with strong supports, can be more effective than delaying access to high school math until 10th grade. Two successful programs, the Early College High School model and the "Algebra Initiative," combined high expectations, student-centered instruction, and extensive professional development for teachers, helping students succeed in Algebra I instead of being assigned to remedial courses, which often carry negative academic side effects.

Middle school students who demonstrate readiness should have access to Algebra I. Training and incentives for Algebra I teachers, along with virtual course options for schools that lack in-person offerings, can help expand availability.

- While in-person Algebra I instruction is more effective, offering an online 8th-grade Algebra I option is a practical solution for small schools that lack a qualified teacher or enough students to fill a class section, ensuring students aren't denied access altogether. In 2024, 35% of Chicago Public Schools' middle schools that had no on-site Algebra I teacher began offering online Algebra I.
- Monetary incentives to recruit and retain teachers in hard-to-staff subjects are effective but costly. Providing bonuses to Algebra I teachers could encourage middle school educators to teach more advanced coursework and high school teachers to teach a course sometimes perceived as undesirable at the high school level.
- To encourage Algebra I-specific training, Chicago Public Schools partnered with local universities to develop an Algebra credential connected to financial incentives and master's degree credit. Content expertise is a crucial component of teacher quality in mathematics.

Placement decisions based on a combination of test scores, rather than subjective referrals or one test score, improve participation and achievement in Algebra I, especially for historically underserved students.

- Using objective criteria (i.e., test scores) for Algebra I placement increases participation and achievement among low-income, Black, and Hispanic students by removing the subjective barriers like teacher recommendations or parent requests.
- Using multiple test scores provides a more accurate picture of student readiness than using just one test score, since different assessments may emphasize different skills (e.g., procedural fluency vs. conceptual understanding). Multiple scores also help smooth out anomalies due to test anxiety or one-time performance issues.
- Wake County replaced subjective placement factors, such as teacher recommendations, with a cutoff score based on multiple academic measures to determine eligibility for accelerated math (leading to Algebra I in 8th grade). This led to increased enrollment, especially among Black, Hispanic, and low-income students.
- Most studies of Algebra I acceleration policies that use test-based thresholds have found that positive effects are concentrated among female students. This implies that capable female students were underidentified for acceleration under subjective systems. However, it also suggests that male students with equivalent content mastery may be lacking equivalent "soft skills" captured by course grades and could require more developmental supports (e.g., building organizational habits) to succeed.
- Research is divided on the use of teacher-assigned grades for course placement: some studies find that GPA predicts academic success better than test scores because it more effectively captures non-cognitive traits. Other research finds that GPAs reflect grade inflation, inconsistency, and bias.

Auto-enrollment policies increase participation and completion rates in accelerated math courses, particularly among underrepresented students, by reducing barriers and signaling that they belong in accelerated pathways.

- Studies at both the middle school and high school levels have shown that more students successfully complete accelerated math courses when they are automatically enrolled compared to when enrollment is opt-in. This is especially impactful for students from historically underserved groups, who are less likely than their peers to enroll on their own, even when they are academically qualified.
- Auto-enrollment policies typically allow families to opt out, maintaining flexibility while reducing the burden on parents to navigate complex course placement systems.
- While formal auto-enrollment policies are relatively new, an early study of Dallas ISD's 2018 opt-out program found that it increased 8th-grade Algebra I enrollment by 13 percentage points and shrunk the Hispanic-White (though not Black-White) enrollment gap.
- One of the advantages of auto-enrollment is that it is low-cost. Compared with tutoring and double-dose, it does not necessarily require hiring additional instructors. While some teachers may need additional training to start teaching more advanced courses, this is likely to be a short-term investment.

While there is no universally optimal threshold for Algebra I placement, prior test scores and predictive tools can accurately estimate student readiness.

- Broadly, lower thresholds will expand access to a more diverse group of students, while higher thresholds are often associated with higher average achievement.
- Probabilistic models based on multiple assessments are more accurate than those relying on fixed benchmarks.
- Free tools, such as the Mathematics Diagnostic Testing Project (used in California), have been found to predict Algebra success.
- Formative assessments, such as MAP, IAAT, i-Ready, STAR, ALEKS, and the Iowa Algebra Aptitude Test, can also provide useful insights, especially when paired with guidance from state education departments on Algebra I readiness indicators.

GROUPING: How should schools group students in Algebra I classrooms given differences in preparation and learning needs?

Any district trying to improve Algebra I access, placement, and success will inevitably confront questions about how to organize instruction for students with varying levels of preparation. The goal of this brief is not to dictate a single solution, but to provide the best available evidence on the tradeoffs involved and offer guidance on minimizing negative consequences for whichever approach a district chooses.

Placement decisions that are based on students' current learning needs, made separately by subject, and revisited regularly, create flexibility and strong academic outcomes. In contrast, rigid tracking systems that start in early grades reinforce existing opportunity gaps and have negative impacts.

- Student outcomes depend heavily on how tracking is designed and implemented. When schools use recent, multiple measures of achievement, such as predictive placement models or composite readiness scores, and revisit placements regularly, tracking can help ensure students receive instruction at the right level and pace. This is shown to be effective in studies where test scores are used to enroll students in Algebra when they are academically ready.
- Reassessing placement at key transition points (e.g., each semester or year) and offering pathways like concurrent enrollment in Algebra I and Geometry could allow students to move across tracks.
- When class placement decisions are made early based on teacher recommendation, parental pressure, or a single outdated test score, students can be unfairly sorted into lower tracks with limited opportunities to advance.
- Evidence from European-style early tracking shows that sorting students early into fixed pathways can widen academic inequality and lower overall achievement.

Key mechanisms of tracking effects:

- **Instructional targeting:** Teachers often teach to students near the middle of the achievement range. This can leave both high- and low-achieving students under-challenged or unsupported, and they tend to learn less than they would from more tailored teaching.
- **Peer influences:** On average, students benefit academically from having higher-achieving classmates, though these effects are generally small and depend on classroom context and student composition.
- **Teacher and self-perception:** Students' placement influences how they see themselves and how teachers see them in complex ways. While students placed in lower-level courses can face reduced expectations from teachers and internalize negative messages about their ability, these effects can be offset by the "big-fish-small-pond" dynamic, which is when students feel more confident and motivated when they are among the higher performers in their class. Because these psychological forces work in opposite directions, there are likely smaller overall impacts on student identity and motivation than previously assumed.
- **Resource distribution:** Tracking can lead to inequitable access to strong teachers and materials. Tracking is associated with smaller class sizes, which likely benefits students who are lower achieving. However, lower-achieving class sections (the very students who need the most skilled instruction to accelerate their learning) tend to be assigned less qualified, lower value-add, and less experienced teachers. This suggests that without deliberate staffing policies and support structures, tracking can unintentionally reinforce achievement gaps by systematically denying struggling students access to high-quality teaching.

Tracking exists on a continuum. Since no grouping strategy benefits all students equally, district leaders must weigh trade-offs in light of local priorities and resources. Below are the studied outcomes from similar-proficiency (i.e., tracked) and mixed-proficiency (i.e., detracked) classrooms.

Similar-proficiency (i.e., tracked) classrooms enable more targeted instruction and can benefit both middle- and high-achieving students. But they also tend to widen achievement gaps, increase segregation, and can create negative self-perceptions for students in lower-achieving class sections.

Potential benefits of similar-proficiency (i.e., tracked) classrooms:

- Stronger outcomes for middle and high achievers: Grouping by skill level can improve academic performance for middle and high achievers. One study found that students assigned to double-dose Algebra were more likely to persist in and complete college, but only when they were grouped with similarly skilled peers. The program had no effect when students were placed in double-dose classes with much lower-skilled peers.
- No harm, and possible benefit, for lower achievers: Evidence suggests tracking does not negatively impact low-achieving students and may even slightly improve their performance.
- Enables more targeted instruction: Teachers can better tailor the pace and content when student skill levels are aligned.
- Gains for Black and Hispanic high-achievers: When test scores were used to place high-achievers in gifted classrooms, Black and Hispanic students saw the greatest gains.

Potential drawbacks of similar-proficiency (i.e., tracked) classrooms

- Widened achievement gaps: High achievers tend to benefit more from tracking than lower achievers, which widens existing disparities.
- Increased segregation: Tracking often reinforces racial and socioeconomic divisions within schools, which increases as students age and tracking becomes more prevalent. Exposure to within-school segregation in elementary and middle school is correlated with lower student achievement, especially for Black students.
- Negative student and teacher perceptions: Students in and teachers of lower tracks are typically aware of this placement, which can hurt student confidence and teacher expectations.
- Behavioral challenges: Lower-track classrooms are more likely to experience behavioral disruptions than mixed-achievement classrooms.
- Limited opportunities to advance: Even when tracking is technically on a "course-by-course" basis, being tracked into remedial coursework for one subject reduces the likelihood of taking on-level or accelerated classes in other subjects. This effect is especially strong for Black students.

Mixed-proficiency (i.e., detracked) classrooms offer all students access to rigorous coursework and more inclusive learning environments, but risk discouraging lower-achieving students and slowing progress for high-achieving students

Potential benefits of mixed-proficiency (i.e., detracked) classrooms:

- Positive peer influences for low- and moderate-achieving students: Students with moderate skill levels often benefit from exposure to high-achieving peers. Those with very low skills may also benefit, though these peer effects are typically modest.
- No harm for high achievers, with careful implementation: Studies of detracking policies that featured significant teacher training and student support did not find any negative impacts for those at the top of the classroom skill distribution.
- More inclusive classrooms: Mixed-proficiency settings foster cross-group relationships, which align with the goals of public education and can promote upward mobility.
- Equity in access: In mixed-proficiency classrooms, all students receive access to the most rigorous coursework available without structural barriers.

Potential drawbacks of mixed-proficiency (i.e., detracked) classrooms:

- Struggling students may fall behind: Large skill gaps can overwhelm less prepared students, especially if they compare themselves to higher-achieving peers.
- Slower progress for most: Teaching mostly to the one group in mixed-achievement settings limits academic growth for everyone else.
- Declines for advanced students: Introducing lower-achieving peers to Algebra I classes can reduce performance among high achievers. This is more prevalent in districts where detracking is disruptive (e.g., many teacher-course switches) and not accompanied by aligned supports (e.g., teacher training). Negative behavioral spillovers from disruptive peers may also occur.
- Highlights unequal family resources: Detracking frequently faces resistance from parents, especially if it is perceived to reduce access to advanced learning; wealthier families may seek private alternatives, increasing inequality.
- High demands on teachers: Effective differentiation for a classroom with widely differing learning needs is essential, but requires training, time, and other resources, such as tutors or paraprofessionals, that teachers often lack. Without these supports, teachers may struggle to meet diverse learning needs, leading to understandable resistance.

Effectively supporting a wide range of academic proficiency levels in one classroom requires teachers to have advanced skills, sufficient planning time, and access to strong instructional resources.

- Districts can enhance teacher capacity to effectively adapt instruction to student needs by investing in professional development and coaching, which have been proven to improve teacher skills. One highly supportive detracking program even provided teachers with an additional planning period and a partner teacher to help teachers adapt to mixed-proficiency classrooms.
- Frequent formative assessment, via digital tools or in-class strategies like math language routines, helps teachers adjust instruction in real time. Flexible grouping, which temporarily groups students by skill level and is regularly updated, produces small positive effects in math.

SUPPORTS: What instructional supports help students succeed in Algebra I, especially those who start behind?

Students learn best at their "learning edge," the space between what they can accomplish independently and what they can do with expert support. The following practices help schools design instruction and support systems for Algebra I students with wide-ranging needs.

Extended or supplementary Algebra I instruction during the school day has been shown to improve both short-term achievement and long-term educational outcomes.

- "Double-dose" Algebra gives students two math periods per day and has been shown to improve outcomes for underprepared students.
  - The extended Algebra model doubles student class time in an Algebra I course. When Chicago Public Schools required underprepared 9th-grade students to take two periods of algebra instead of one, student test scores increased. It also led to longer-run gains in college entrance exam scores, high school graduation rates, and college enrollment rates.
  - Supplementary math models enroll students in one section of Algebra I and one additional math support section, which emphasizes "just-in-time" remediation of foundational concepts. This structure has been repeatedly proven effective in postsecondary education.
- Staggered math blocks (i.e., not back-to-back) facilitate spaced practice, which improves student retention, though research is mixed on whether staggered or block scheduling is more effective overall.
- Trade-offs to increasing instructional time during the school day include high staffing costs and the potential for double-dosing math to crowd out student effort in other subjects or reduce access to electives that may be an important source of school engagement.

Tutoring, especially when delivered in small groups, multiple times per week, and during the school day, is one of the most effective academic interventions.

- A meta-analysis of 21 RCTs found that math tutoring generates about a 10 percentile learning gain, on average, which is a large effect for an educational intervention.
- Key features of high-impact tutoring include integration into the school day, data-informed instruction, a consistent, well-supported tutor, high-quality instructional materials, and delivery multiple times per week.
- In Chicago, 9th graders who were randomly assigned to receive high-impact tutoring outperformed their peers in double-dose Algebra on end-of-course exams. The study also found that providing Algebra I tutoring during the school day, either in an intervention block or in place of a "double dose" support elective, was more cost-effective than conventional "double dose."
- In Norway, providing small-group instruction with additional teachers in mixed-proficiency classes helped students across all skill levels.

Online platforms and GenAI tools offer the potential for personalized math instruction, but research on their effectiveness is still emerging.

- Online tutoring is better than no tutoring, but it is generally less effective, though lower cost, than in-person tutoring.
- Many online platforms (e.g., IXL, ALEKS) provide personalized instruction to students, but their effectiveness has generally not been independently evaluated.
- AI tools need clear guardrails and thoughtful implementation to be effective. One study found that students who used an AI chatbot for high school math tutoring learned less than students without any assistance because the "tutor" was used as a crutch in place of engaged student practice. However, students who received "hints-only" from a chatbot had greater gains than those with human tutors, despite the chatbot's frequent errors.
- GenAI also shows promise for real-time coaching of online tutors in Algebra I. A randomized trial of Tutor CoPilot, a low-cost human-AI coaching tool, found that it helped tutors use more effective teaching strategies and improved student mastery, especially for lower-rated tutors.

Summer bridge programs can help students build the skills and confidence needed for success in Algebra I, though evidence of their effectiveness is limited.

- Summer bridge programs and boot camps that help students develop study skills and growth mindsets to prepare them for higher-level classes have been found to promote success in math courses at the postsecondary level. Additionally, a 19-day Algebra I bridge program in California raised the share of Algebra-ready students from 12% to 29%, although downstream outcomes were not measured.
- Algebra I teachers have identified fractions, decimals, and rational numbers as areas where students struggle, suggesting that effective bridge programs should emphasize these topics.

More to learn: Districts are testing a range of additional strategies to improve Algebra I access and support, though most lack systematic evaluation. Examples include: paying students to participate in Algebra I remediation, offering innovative models like a two-year Algebra I course, universal pre-Algebra in grades 6–7, compressing grades 6-8 Common Core material to facilitate 8th grade Algebra I, summer school Algebra I as an alternative to a yearlong course, and simultaneous enrollment in 8th-grade math and Algebra I and/or Algebra I and Geometry to accelerate students without compressing content.

PRACTICES TO AVOID

Policy shifts that either delay Algebra I for all students or accelerate them without strong, integrated supports are unlikely to meet the diverse learning needs of students.

- Placing all students in the same math course at the same time aims to prevent disparities by race, class, and gender. However, universal early or delayed Algebra I has not reduced long-standing gaps in high school math attainment and can lower overall achievement.
- A more effective approach strikes a balance between broad access and content mastery. This likely requires varied entry points based on student readiness or significant (and often costly) investments in differentiation and instructional support.

Algebra I policies that are evaluated solely on pass rates overlook their longer-term impact on math achievement, course progression, and readiness for postsecondary success.

- One study found that accelerating underprepared 9th graders into Algebra I increased initial failure rates; however, by 11th grade, those students had higher average test scores and progressed further in math than their peers in remedial courses.
- Similarly, policies that increase short-term pass rates, such as those that universally delay Algebra I to 9th grade, can unintentionally reduce access to advanced math later in high school.

A narrow focus on Algebra I as a measure of math success ignores other key factors, such as early preparation, later coursework, and long-term college readiness.

- Improving K-5 math instruction is central to preparing a wider group of students to succeed in Algebra I by 9th grade.
- In many states, graduation requirements do not extend beyond Algebra II, which can leave students underprepared for college-level math unless schools actively encourage continued coursework through 12th grade. Additionally, studies have found that taking math as a senior may ease the high school to college transition.
- Despite its centrality to K-12 math debates, research on the comparative value of high school Calculus versus Statistics is limited. A recent study of Texas high school graduates shows that both provide opportunities for students to thrive in college and career. While high school AP Calculus AB students were more likely to pursue STEM degrees and attend selective universities than AP Statistics students, they did not earn higher incomes.

Proficiency-based placement into Algebra I can unintentionally lock students into rigid groups across subjects, which amplifies the negative consequences of tracking for social integration.

- Master scheduling often groups students across subjects based on their math placement, limiting valuable cross-class friendships and access to broader learning experiences. Districts can counter rigidity by offering “level-up” opportunities, such as allowing successful 8th-grade math students to take Algebra I and Geometry concurrently in 9th grade.

- Early Algebra I is sometimes seen as a "status symbol," driving parent intervention and placement decisions based on prestige rather than readiness. Therefore, placement decisions that are framed as responsive to students' current math learning needs rather than judgments of overall intelligence or academic worth help reduce stigma and support more effective, tailored instruction.

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