Launch Years: A New Vision for the Transition from High School to Postsecondary Mathematics

Launch Years
an initiative of

The University of Texas at Austin
Charles A. Dana Center

CCRC COMMUNITY COLLEGE RESEARCH CENTER
TEACHERS COLLEGE, COLUMBIA UNIVERSITY

Achieve

ESG Education Strategy Group

Association of Public & Land-Grant Universities

2020

Somewhere in the United States...

A recent high school graduate is excitedly starting her first semester in college. While she passed advanced mathematics courses her senior year in high school, her university informs her she is not "college ready" in mathematics.

A high school student decides not to take any mathematics courses beyond those required for graduation, because nothing in his experience has helped him see how mathematics is relevant to his future.

Another student is steered away from advanced mathematics courses by her counselor, based on that counselor's perceptions about her race or family background.

Still another student wants to take additional mathematics courses but cannot—because his school does not offer them.

And somewhere, a recent university graduate, having successfully navigated the transition into and through college mathematics, finds that what he learned in his mathematics courses did not prepare him with the quantitative skills he needs for his future.

Together, we can change these stories...

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Increasing Equity in Mathematics Education

The Launch Years Position Statement

Each student should feel empowered and engaged as a mathematical learner, experience success in mathematics, and become fully prepared for the quantitative demands of their future careers and lives.

It is unacceptable that our current system of mathematics education fails to meet the needs of so many of our students. It is reprehensible that so many students' opportunities to succeed are limited by their race or economic class.

We have a moral and a professional obligation to create the conditions necessary for every student to succeed.

The Launch Years initiative intends to create those conditions through two overarching aims.

The first is to improve learning opportunities for each student during the last two years of high school and into the transition to their postsecondary education and other future endeavors.

The second is to dismantle institutional and systemic barriers that block equitable access and opportunities to succeed in mathematics, especially for students who are Black, Latinx, or Native American, or who come from low-income communities.

To create greater equity in students' mathematical experiences—and to significantly improve educational achievement and attainment for these historically underserved groups of students—we commit to move beyond the concept of "closing achievement gaps." Focusing only on so-called "achievement gaps" inappropriately privileges and normalizes the performance of some groups of students while creating a deficit-based narrative and limiting expectations for other groups.

The Launch Years vision is to build, scale, and sustain policies, practices, and structures that ensure that each student has equal access to, and successfully engages in:

- **Mathematics courses** with rigorous, relevant, engaging, high-quality, and inclusive instruction that is responsive to the needs of individual students and that is informed by multiple measures of achievement that are economically and culturally inclusive;
- **Mathematics pathways** that are well articulated from high school to and through postsecondary education and careers, that are personally and socially relevant, and that enable students to move across pathways as their interests and aspirations evolve;

The Launch Years commitment to equity focuses on improving outcomes for Black, Latinx, and Native American students as well as students from low-income communities.

We have chosen to focus on these populations because we believe this is where the Launch Years strategies can have the greatest impact.

We recognize that other groups, including girls and women, English-language learners, and students with disabilities, are also marginalized in mathematics education. Nor are the problems of inequity limited to the transition from high school to postsecondary opportunities.

The changes proposed in the Launch Years recommendations will likely benefit all populations, and those benefits will likely extend beyond the transition years.

We look forward to opportunities to coordinate and collaborate with other organizations to help expand the scope and impact of the Launch Years work in ways that increase access to an excellent mathematics education for all students.

- **Individualized academic, career, and other student supports** that respect and promote student and family decision-making and that enable students to explore options, make strategic choices, and set and achieve informed goals.

In addition to these structural changes, we commit to challenging and eliminating institutional and systemic barriers to students' opportunities to access—and succeed in—mathematics. This commitment includes proactively working with partners to change institutional cultures and educator mindsets toward recognizing and building upon student assets and student strengths.

While the Launch Years initiative advocates offering new mathematics pathways in parallel with the pathway leading to calculus, we do not minimize how important calculus remains for many students. Student enrollment and success in all mathematics pathways should reflect the demographics of the student population. Unfortunately, many populations continue to be underrepresented in fields that require calculus. Therefore, an important aspect of our work remains strategic and intentional efforts to establish structures, policies, and practices to promote inclusion and success of underrepresented populations in calculus and calculus-based fields.

General efforts to improve mathematics education have value, but will not in themselves create more equitable outcomes for students. The Launch Years initiative takes the position, therefore, that our efforts to improve mathematics education must intentionally and explicitly seek to improve equity in student learning, course outcomes, and attainment of credentials that promote upward social mobility and increase informed engagement in a democratic society.

We look forward to collaborating with other organizations, institutions, and individuals in this journey to ensure all students' equitable access to the mathematics necessary for lifelong success.

Launch Years initiative

An Overview of the Launch Years Work

Reimagining Mathematics Education

An Overview of the Launch Years Work
Reimagining Mathematics Education

All students deserve equitable access to an excellent mathematics education.

That's been the vision, and the driving passion, of the Charles A. Dana Center at The University of Texas at Austin for nearly three decades. We believe that all students, from early childhood through college and beyond, deserve an equal opportunity to experience the joy of learning mathematics—and to acquire skills that set them on a path toward success in any future they choose.

Over the years, we have worked across every level of the K–12 and higher education systems. We draw on research to develop tools and resources that support educators in transforming their systems and institutions at scale through effective pedagogy, curriculum, instruction, professional learning, and policy.

The Dana Center is one of a few organizations nationally that brings to the table deep expertise in K–12 *and* higher education—and that works from the classroom up through state policy.

The demand for people with strong mathematical skills continues to grow. Yet far too often, the education that students receive is not keeping pace with the mathematics they'll need in an ever-changing world.

Now, more than ever, we see a critical need to offer all students a mathematics education that is designed to achieve equitable outcomes and that is rigorous and relevant for their futures.

Improving the transition from K–12 to postsecondary education

At the Dana Center, our vision for creating equitable access—and our policy and practice experience implementing mathematics pathways across systems—has sharpened our focus on the needs of students and educators in the critical transition space between high school and postsecondary education.

We are exploring how we can support education leaders in better aligning what is taught and learned in K–12 and higher education systems to better serve students transitioning from grade 11 into their postsecondary futures.

By supporting the development of high-quality mathematics pathways for students, we can help them gain the skills they need to thrive in their chosen careers and future lives—while at the same time strengthening our nation's workforce.

And so, in 2018, we kicked off the Launch Years initiative.

Led by the Dana Center, Launch Years is bringing together experts, practitioners, and other leaders from K–12, higher education, policy, research, business and industry, and equity advocacy to codify and support efforts to build mathematics pathways from high school through postsecondary education and into the workplace.

Mobilizing change through collaboration

The Dana Center is working alongside Education Strategy Group, Community College Research Center, and the Association of Public and Land-grant Universities in a Launch Years collaborative that aims to improve the alignment between the mathematics taught in high school and the mathematics needed for postsecondary success.

This work includes

- establishing policies and practices that will lead to improved and more equitable outcomes for all students—particularly students who historically have been marginalized including students who are Black, Latinx, or Native American, or who come from low-income backgrounds.
- supporting relevant and rigorous mathematics pathways that engage students in high school, propel them to postsecondary opportunities, and prepare them for the quantitative demands of their future lives.

In the first years of the project, intensive Launch Years work is taking place in three states—Georgia, Washington, and Texas—selected for their previous experience and success in mathematics pathways work.

Each state is committed to creating clear, relevant pathways from secondary to postsecondary mathematics and to sharing their key learning with states and districts around the country.

The Launch Years collaborative has produced this report to mobilize efforts around a common, collaboratively developed vision of systems that support students in transitioning from secondary to postsecondary mathematics.

The Launch Years collaborative has also mobilized individuals representing organizations from around the country to participate in the **Launch Years Consensus Panel**.* These leaders played a key role in developing the report that follows.

The report frames the critical issues that affect student progress from high school through postsecondary mathematics, and it offers coordinated recommendations for ways we can move forward, together.

Learn more about the Launch Years initiative and sign up for updates at **utdanacenter.org/launchyears.**

*For a complete list of the Launch Years Consensus Panel members, please see the Dana Center's Launch Years page, https://www.utdanacenter.org/our-work/k-12-education/launch-years

Launch Years initiative

Why Launch Years? Why Now?

- Executive Summary
- Call to Action

Why Launch Years? Why Now?
Executive Summary

Why Launch Years?

Too many of our students are blocked from postsecondary and career opportunities by inequitable opportunities to learn that are fueled by misaligned and outdated mathematics requirements and policies.

Postsecondary options include

- **Certification**
- **Apprenticeship**
- **Two- and four-year degrees**
- **Education opportunities in the military**

The Launch Years initiative aims to remove these barriers by mobilizing a coordinated movement to develop new mathematics pathways that propel students smoothly from high school through postsecondary education and into the work world.

One of the most urgent education issues of our time is ensuring equitable access to an excellent, and progressively more advanced, mathematics education for all students. The rapidly evolving labor market and the quantitative demands of daily life require increasingly sophisticated mathematical knowledge and skills. And we see exciting potential for greater, and more diverse, applications of mathematics for everyday people in everyday life.

Yet, a mathematics pipeline that experts term "dysfunctional"* is contributing to inequitable access to postsecondary opportunities such as certifications, apprenticeships, two- and four-year college degrees, and education options in the military. These inequities particularly affect students who are Black, Latinx, Native American, or who come from low-income backgrounds.

*See, for example, page 5 in Phil Daro and Harold Asturias. (2019 October). *Branching Out: Designing High School Math Pathways for Equity.* Berkeley, CA: Just Equations. Available via https://justequations.org/resource/branching-out-designing-high-school-math-pathways-for-equity

About the Launch Years Collaborative and This Call to Action

In 2019, the Charles A. Dana Center at The University of Texas at Austin convened the Launch Years Consensus Panel—made up of leaders representing K–12 and higher education, state governance, business and industry, research, and equity advocacy—to join a collaborative effort to establish a new vision for the transition from high school mathematics to postsecondary success.

The Consensus Panel helped develop this **Call to Action** and a set of supporting recommendations to mobilize action across sectors and stakeholder groups. The full-length call to action and the recommendations are included in the complete report: *Launch Years: A New Vision for the Transition from High School to Postsecondary Mathematics*.

We are optimistic that policymakers, researchers, educators, and other leaders across the K–12, higher education, business, and workforce sectors will heed the Launch Years collaborative's call. Many already recognize the need for change and have begun work.

Together, we can remove barriers and create new pathways so that all students can pursue postsecondary training and education, enter into rewarding careers, and engage in society as quantitatively literate consumers and citizens.

The Case for Change

Three major barriers impede students during the crucial transition from their junior and senior years of high school mathematics through their first year of postsecondary education.

1) Students experience inequitable opportunities to learn.

A large body of research literature documents the many inequities—from the state policy level down to local implementation—in American students' opportunities to learn and succeed in mathematics.

Mathematics requirements vary across states, but the high school mathematics curriculum commonly offered across the nation has been, and remains, a course in geometry sandwiched between two courses in algebra, advancing students on a narrow pathway toward calculus. This course sequence fails to serve most students.

The quality of local curriculum and instruction varies, with students coming from higher-income backgrounds tending to have access to higher-quality programs. Access to advanced courses is too often influenced by race or family income. And inequitable access to courses and effective instruction may reflect, or be exacerbated by, educators' biases and racial stereotypes about mathematics ability—all of which interfere with student learning.

2) Mathematics is misused in college admissions criteria.

The negative effects of inequitable opportunities to learn in high school are amplified by inconsistent and often arbitrary college admissions requirements across states—and across institutions of higher education.

Many colleges and universities use mathematics as an admissions gatekeeper. Admissions requirements often explicitly stipulate that a student must have completed Algebra II. Yet requirements that prioritize algebra have little to no relation to students' readiness to succeed in courses such as statistics or quantitative reasoning—which are more relevant to a wide range of credentials and careers.

College admission standards requiring Algebra II signal to high schools, parents, and students that courses leading to calculus are the best, or only, mathematics options to pursue in preparation for college. Yet there is mounting evidence that those students who do not take the traditionally required algebra courses and sequences are still successful in college.

3) Postsecondary readiness policies are inconsistent and misaligned.

The definition of *postsecondary readiness* varies across K–12 and higher education, leading to incoherent articulation of coursework requirements across the sectors. How postsecondary readiness is defined, and how that definition is used, often determines whether a student will be required to repeat courses or be placed into non-college-credit remedial courses, both of which are barriers to on-time graduation.

This lack of a shared understanding between K–12 and higher education of what constitutes postsecondary readiness raises the question of whether high schools can adequately prepare students for postsecondary education. High school students are too often told to aim for a certain standard or course sequence, only to find that after they graduate, the criteria at their new institution are different. And such experiences naturally most negatively affect families with less understanding of—and experience with—postsecondary education, as they of necessity must rely more heavily on the guidance provided by their local K–12 schools.

The Opportunities for Action

While the barriers we have described are not new and may feel intractable, we see opportunities for positive, achievable change. Four opportunities in particular hold promise:

1) Advanced quantitative literacy skills are increasingly in demand.

Quantitative literacy is increasingly important for informed participation in our society and democracy. In addition, new and expanding fields of work center on working with data and on quantitative analysis and reasoning. Just as important, many existing fields, such as social work and nursing, are increasingly relying on data-driven analysis to inform research and decision making.

But employers and studies on workforce needs report a lack of in-demand math skills. Some cite a lack of general math skills, while others are more specific about the kinds of skills—such as mathematical modeling and statistical analysis—that are increasingly in demand yet difficult to find in the U.S. labor force.

More than half of those pursuing higher education say that their primary reason for doing so is to get a good job.** It is essential, then, that our education systems collaborate to respond to these new and diverse applications of mathematics and to prepare students appropriately and equitably.

2) Mathematics leaders are calling for modernizing mathematics pathways.

Mathematics professional associations across education sectors are reaching an emerging consensus that algebraically intensive courses, such as College Algebra, ought not to be the default requirement for all students.

These associations make the case that students are not well served by the traditional College Algebra course; thus, mathematics pathways focused on problem solving, modeling, statistics, and applications should be developed and aligned to the mathematics requirements in students' intended fields of study. Importantly, this redesign creates an opportunity for new mathematics pathways to be designed to achieve more equitable outcomes.

3) Higher education innovations are increasing options, equity, and success.

The higher education sector is responding to the call to modernize mathematics content with widespread implementation of multiple mathematics pathways that offer differentiated, rigorous mathematics options tailored to students' academic and career goals. In addition, more institutions of higher education are implementing co-requisite models that enable more students to enter immediately into college-credit-bearing courses with support. Colleges and universities are also

**Strada Education Network and Gallup. (2018 January). *Why Higher Ed? Top Reasons U.S. Consumers Choose Their Educational Pathways*. Indianapolis, IN: Author. Available at https://futureu.education/wp-content/uploads/2018/03/Strada-Gallup-January-2018-Why-Choose-Higher-Ed.pdf

using a variety of measures for college placement that may include factors other than a placement test, such as student performance in relevant high school coursework.

There is evidence that mathematics pathways with co-requisite supports combined with new placement practices are drastically increasing student success across demographic groups. These findings call into question preconceptions about the ability and postsecondary readiness of students, particularly those students who have historically been marginalized by the system.

4) Innovations in K–12 systems are showing promise.

Efforts to create new mathematics pathways in higher education provide the K–12 sector with the opportunity to re-envision high school mathematics as well. The National Council of Teachers of Mathematics recommends moving away from the traditional high school mathematics sequence and instead moving toward courses that cover essential concepts—such as statistics and mathematical modeling—for all high school students. NCTM also advises that after these courses, students should choose a fourth-year course based on their personal and professional goals.

Some states and districts are heeding this call to establish new pathways in statistics, mathematical modeling, and the data sciences. Others are also addressing policies and practices to increase student success and achieve more equitable outcomes.

We see strong interest in engagement across sectors as part of state-level mathematics pathways work and in a recent forum held by the Conference Board of the Mathematical Sciences in which 22 states participated. The dramatic increase in dual enrollment is also driving collaboration at the local level.

Conclusion: The Launch Years Call to Action

No student should face unnecessary obstacles in the transition from high school to postsecondary education.

We acknowledge that the work ahead includes many challenges, including

- Removing outdated, irrelevant, and misaligned gatekeeper requirements to college access and college completion;
- Creating mathematics courses that prepare students for programs, careers, and lives that engage a range of mathematical skills; and
- Monitoring student enrollment patterns and outcomes to measure explicitly whether equity is being achieved.

All students should leave high school prepared to engage in college-level mathematics aligned to their future goals—and ready to pursue, and succeed in, their chosen postsecondary pathway.

It is our collective responsibility, then, to

- Address systemic factors that create obstacles to success and that fuel inequity.
- Ensure that our education systems help students expand their ideas of what is possible and what they can achieve.
- Enact new policies, structures, and practices that propel students forward to successful futures.

Launch Years: A New Vision for the Transition from High School to Postsecondary Mathematics

Find the full report online at https://utdanacenter.org/launchyears

Please cite the full report as follows:

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https://utdanacenter.org/launchyears

The full report includes the Launch Years collaborative's

- "Call to Action," summarizing the case for change and the opportunities for action and
- "Taking Action on Launch Years," detailing recommendations and strategies for advancing the movement.

It also includes an extensive list of references that informed the development of these resources.

Why Launch Years? Why Now?

A Call to Action from the Launch Years Collaborative

Somewhere in the United States...

A recent high school graduate is excitedly starting her first semester in college. While she passed advanced mathematics courses her senior year in high school, her university informs her she is not "college ready" in mathematics.

A high school student decides not to take any mathematics courses beyond those required for graduation, because nothing in his experience has helped him see how mathematics is relevant to his future.

Another student is steered away from advanced mathematics courses by her counselor, based on that counselor's perceptions about her race or family background.

Still another student wants to take additional mathematics courses but cannot—because his school does not offer them.

And somewhere, a recent university graduate, having successfully navigated the transition into and through college mathematics, finds that what he learned in his mathematics courses did not prepare him with the quantitative skills he needs for his future.

Introduction: *Why Launch Years?*

We envision a future in which every student is supported to learn mathematics, sees mathematics as relevant to his or her life and goals, and is able to transition smoothly from secondary to postsecondary education.

But too many of our students have experiences like those described above. They are blocked from college and career opportunities by misaligned and outdated mathematics requirements and policies. Institutional and systemic bias create additional challenges for marginalized students, including those who are Black, Latinx, or Native American, or who come from low-income backgrounds. Many states, institutions, and school districts across the country have made progress removing these barriers, but these efforts have not yet been broadly implemented across K–12 and higher education.

The Launch Years collaborative aims to move beyond this status quo with a new paradigm for college and career readiness in mathematics. Building on work already underway, we seek to mobilize a coordinated movement to develop new mathematics pathways from high school through postsecondary education and into the work world.

About the Launch Years Collaborative and This Call to Action

In 2018, the Charles A. Dana Center at The University of Texas at Austin began mobilizing individuals and organizations to advance the Launch Years work.

We informally refer to this coalition as the Launch Years collaborative.

A core component of this collaborative is the Launch Years Consensus Panel, which includes leaders representing K–12 and higher education, state governance, business and industry, research, and equity advocacy.

In 2019, the Consensus Panel helped develop this Call to Action to encourage our colleagues and constituents to join us in establishing a new vision for the Launch Years—the transition from high school mathematics to postsecondary success.

The Consensus Panel also helped develop recommendations that define how we can collectively move towards making that vision a reality. These recommendations are included in a later section of this report.

See the full list of Consensus Panel members at https://www.utdanacenter.org/our-work/k-12-education/launch-years/launch-years-consensus-panel.

These pathways will be supported by structures, policies, and practices to propel students through junior- and senior-level high school mathematics courses and into—and through—the best option for each student from among the range of postsecondary paths. These paths include certification, apprenticeship, two- and four-year degrees, and education opportunities through the military.

Postsecondary options include

- **Certification**
- **Apprenticeship**
- **Two- and four-year degrees**
- **Education opportunities in the military**

Why Now?

We have become a nation of postsecondary haves and have-nots. Inequitable access to college (and inadequate supports for student success and attainment of a credential or degree) is due in part to a mathematics pipeline that experts term "dysfunctional."[1]

Inequitable access to postsecondary opportunities contributes to growing inequality.[2] At the same time, the rapidly evolving labor market and the quantitative demands of daily life require increasingly sophisticated mathematical knowledge and skills. And we see exciting potential for greater—and more diverse—applications of mathematics for everyday people in everyday life, both personally and professionally.

Thus, learning—and progressing—in mathematics is one of the most urgent education issues of our time.

But our education systems are lagging behind.

Effecting change at scale will require concerted efforts from, and collaboration among, policymakers, researchers, educators, and other leaders across the K–12, higher education, business, and workforce sectors. Many already recognize the need for change and have begun work.

We are optimistic that these leaders and others will heed the Launch Years collaborative's call to remove barriers and create new structures so that all students can pursue postsecondary training and education, enter into rewarding careers, and engage in society as quantitatively literate consumers and citizens.

The foundation and rationale for the Launch Years initiative is grounded in a clear and compelling case for change. In what follows, we go deeper into the evidence for change through an overview of the barriers to student progress posed by current math policies, structures, and curricula. We then outline some promising opportunities for action.

The Case for Change

Here we focus on three major barriers that impede students during the crucial transition from their junior and senior years of high school mathematics through their first year of postsecondary education:

- Students experience inequitable opportunities to learn,
- Mathematics is misused in college admission criteria, and
- Postsecondary readiness policies are inconsistent and misaligned.

Barrier #1: Students experience inequitable opportunities to learn.

A large body of research literature documents the many inequities in American students' learning conditions. A particular area of focus in such research is inequity in mathematics opportunities and outcomes.[3] Our summary of the research examining these inequities starts at the state policy level and extends down to structures and practices at the institutional level.

Mathematics requirements vary across states.

State policies vary as to the number of years of mathematics required for high school graduation, with a handful of states requiring only two.[4] The high school mathematics curriculum commonly offered across the nation has been, and remains, a course in geometry sandwiched between two courses in algebra. This course sequence is meant to prepare students for calculus; as the research demonstrates, it fails to serve most students.[5]

States differ as to whether Algebra II is required or just recommended for high school graduation, but most high school students must complete the course,[6] due to the perceived or real admissions requirements of various institutions of higher education. Yet it is unclear whether American students' mathematics knowledge and skills have actually improved as a result of this broader participation in Algebra II.[7]

Quality of curriculum and instruction varies across schools.

And even when students take a similar number of years or credits of mathematics, the quality of the curriculum and instruction has been shown to vary, with students from higher-income backgrounds tending to have access to higher-quality programs.[8]

Schools vary significantly in terms of their resources and the quality of their teaching staffs, and within schools, students have long been tracked into courses of greater or lesser rigor and quality—ostensibly on the basis of each student's ability but too often actually on the basis of race and family background.[9]

The 1983 report *A Nation at Risk* received particular attention for its urgent language around dismantling tracking in American high schools, and for its call for a commitment to the "twin goals of equity and high-quality schooling." The report also advocated for providing more challenging mathematics courses to more students.[10]

More than 30 years later, the twin goals are still unmet. In 2018, the National Council of Teachers of Mathematics called for the end of student tracking in mathematics—and for the end of teacher tracking, the practice whereby the most experienced teachers (or those perceived to be most effective) are assigned to the highest-level courses.[11]

Access to advanced courses is often influenced by race or family income.

Research shows that inequities continue. Students from more advantaged families—those in the highest socioeconomic quintile (e.g., the richest one-fifth of the population—are more likely to take advanced mathematics courses.[12] White students are overrepresented in "gifted," "honors," and Advanced Placement programs.[13]

Students in lower-resourced high schools, and those in schools with higher enrollments of Black and Latinx students, have less access to high-level mathematics courses than do students in higher-resourced schools and schools with predominantly White student populations.[14] In particular, high-poverty schools on average offer fewer Advanced Placement mathematics courses than do low-poverty schools.[15]

Looking at the demographics of student populations as they progress through higher-level mathematics courses, the enrollment of students from race/ethnicity groups historically underrepresented in science, technology, engineering, and mathematics (STEM) fields decreases as the level of the mathematics courses increases. And in general, there are fewer students from these historically underserved groups in the higher-level courses—that is, in courses that may qualify for college credit—than in the lower-level courses.[16]

Further, inequitable access to courses and effective instruction may reflect, or be exacerbated by, educators' biases and racial stereotypes about mathematics ability[17]—all of which interfere with student learning.

Barrier #2: Mathematics is misused in college admissions criteria.

The inequitable opportunities to learn in high school are problematic for many reasons—and the consequences are amplified by inconsistent and often arbitrary college admissions requirements across states—and across institutions of higher education.

The United States is unique in the world in the wide availability and variety of options for postsecondary education. Yet these options are also highly stratified in terms of who can gain access to which institutions and programs. Graduation from high school satisfies only one of many possible entrance criteria.

Many colleges and universities use mathematics as a gatekeeper for whom they admit.

College and university admissions criteria typically consider the level of mathematics courses students passed in high school, and some look at the grades earned. Admissions requirements often explicitly stipulate a student must have completed Algebra II or a proxy such as Intermediate Algebra. Or admissions require three or four years of high school mathematics—which becomes a de facto Algebra II requirement for high schools in which Algebra II is the only option beyond Algebra I and Geometry.

Many colleges and universities also have required minimum mathematics scores on standardized tests that have a heavy emphasis on algebra, such as the ACT test and/or the College Board's SAT, though submitting these scores is increasingly becoming optional.[18]

These admission requirements that prioritize Algebra have little or no relation to students' readiness to succeed in quantitative courses such as Statistics or Quantitative Reasoning—which are more relevant to many credentials and careers. Sometimes, such requirements create situations in which the mathematics department and its partner disciplines[19] have

implemented non-algebraically-focused mathematics pathways, but admissions criteria still prioritize Algebra II.

Algebra II is used as a proxy for rigor.

The focus on Algebra II is grounded in the commonly held assumption that it is more "rigorous" than other types of mathematics. There are many different definitions of the word *rigor*, and no agreed-upon common meaning in the field of education. The word is typically associated with increased difficulty and challenge, and with "advanced" courses. In high school mathematics, Algebra II has traditionally represented "rigor."

Yet, in academic subjects other than mathematics, *rigor* does not typically refer to the topic, but to the expectations for, and quality of, student work. For example, in history, courses are deemed more rigorous if they require more—and more sophisticated—reading, analysis, argument, and writing; rigor is not automatically attached to, say, the study of the world wars rather than the study of maritime practices in early U.S. history.

In K–12 mathematics, *rigor* is increasingly being used to describe a balanced blend of procedural skill and fluency, conceptual understanding, and application.[20]

In higher education, however, the assumption too often remains that an Algebra II course title functions as a proxy for rigor in the high school mathematics curriculum, and that other mathematics content areas, such as quantitative reasoning and statistics, are not as rigorous.[21] This dynamic creates a false binary—e.g., students are in the "high-level" algebra pathway, or they are not; they are taking rigorous mathematics, or they are not.

College admission standards send a signal to high schools, parents, and students.

This misleading binary often fuels college policies that require Algebra II (and other upper-level mathematics in the algebra-to-calculus pathway), rather than other mathematics courses that might be more relevant to a student's intended program of study.

This practice is self-reinforcing, as it sends a clear signal to high schools, parents, and students that Algebra II and other courses leading to calculus are the best, or only, mathematics options to pursue in preparation for college. A recent report[22] notes that this expectation often pressures secondary students to accelerate through mathematics courses so they can take calculus as early as possible—too often compressing or skipping over other valuable mathematics content.

Using Algebra II as a gatekeeper to college admission might be defensible were there evidence that this content is essential to students' success in college or in their future lives and careers. As we note later in the discussion of higher education reforms, there is mounting evidence that those students who do not take algebra courses that have been traditionally required are still successful in college.

Barrier #3: Postsecondary readiness policies are inconsistent and misaligned.

Students who overcome obstacles to learning in high school and are admitted into a college or university are often upon arrival still assessed to determine if they are "college ready" in mathematics.

This moment in a student's academic trajectory, this critical handoff between high schools and higher education, is at the very center of the transition years. To ensure students'

K–12 and higher education define postsecondary readiness differently.

successful launch out of high school and into postsecondary pathways, this transition requires the highest level of alignment in policy and curriculum—and of communication between K–12 and postsecondary professionals.

The transition revolves around the definition of *postsecondary* or *college readiness*.* How postsecondary readiness is defined (and how that definition is used) often determines whether a student will be required to repeat courses or be placed into non-college-credit remedial or developmental courses—which constitute barriers to on-time graduation and increase student debt.[23]

Given how such delays affect the lives of students, it would be reasonable to expect a high level of alignment between the definitions of postsecondary readiness held by K–12 and by higher education. Rarely, however, does such alignment exist.

For example, the Michigan Department of Education has adopted the College Board's college-readiness benchmark score of 530 on the SAT mathematics test as indicating 11th graders' "proficiency" in the subject. Yet colleges in the state each set their own placement requirements for college-level mathematics courses, and these colleges may require higher scores or use entirely different measures.

Lack of alignment creates confusion for educators, parents, and students.

Staff from the Charles A. Dana Center at The University of Texas at Austin found while working in Michigan[24] that many K–12 and higher education educators were not aware of these different standards across institutions, even within their own region. The gap in information is exacerbated by the fact that there is no central location hosting information on the requirements across institutions. High schools would have to research the requirements at each college to compile the information. This process would have to be repeated periodically to be kept current.

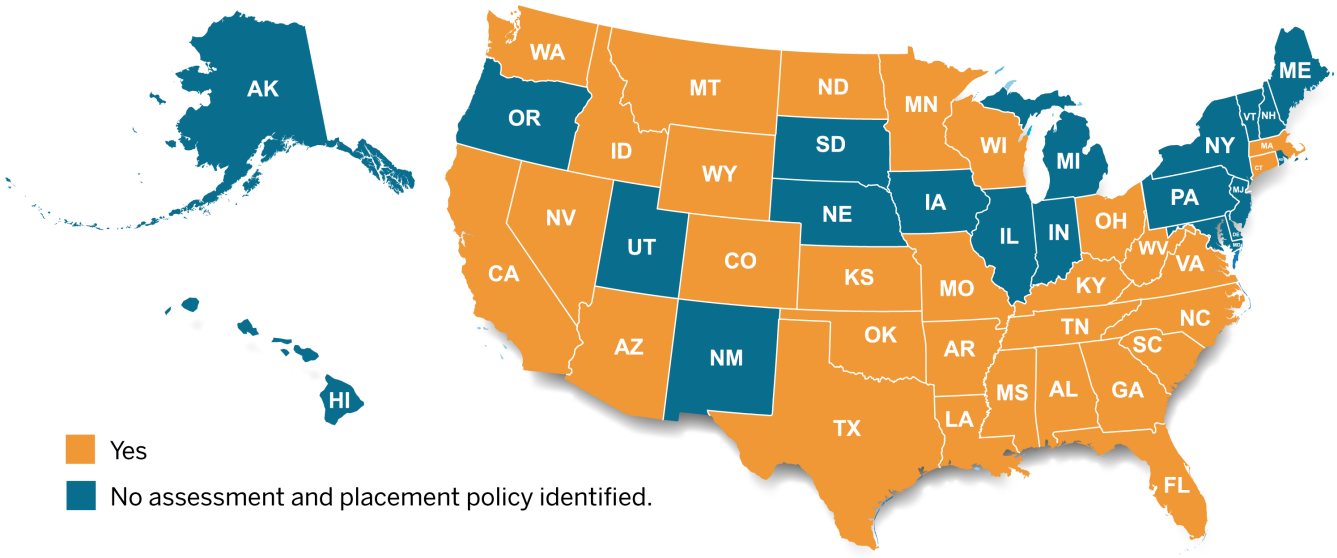
While some states do have more standardized placement practices across their institutions of higher education, there is still lack of alignment with the content that is required in K–12. For example, the Texas Success Initiative (TSI) sets a common assessment for placement into college-level courses at all public colleges and universities in the state. K–12 school districts in Texas also use these measures to designate postsecondary readiness, but districts may also count students as college ready if students pass a course for dual (high school and college) credit, earn credit on an Advanced Placement exam, enlist in the military, or earn an industry certification.

Texas policy does allow students to demonstrate postsecondary readiness through course completion without additional testing, but only through agreements between individual school districts and institutions of higher education. This "college ready" designation is usually limited to one institution, or, at best, to a cluster of regional institutions. Thus, students may think they have demonstrated postsecondary readiness through coursework, only to find that qualification is not applicable at the college or university of their choice.

This lack of coherent articulation between what is understood as "postsecondary readiness" in K–12 and in higher education demonstrates a disturbing lack of coordination across the K–12 and higher education sectors.

**College readiness* is the common term used in policy and practice. We have elected to use *postsecondary readiness* to make it clear that the Launch Years recognizes many postsecondary options beyond those commonly associated with college.

Figure: Developmental Education Policies: Is there a state or systemwide developmental education assessment and placement policy? (Data are as of September 2018.)



It raises the question of whether high schools can adequately prepare students for college when their higher education partners do not agree on what constitutes postsecondary readiness in mathematics. Regional agreements between K–12 and higher education systems can create some alignment and predictability for students, but these agreements also limit options because they apply to only a small number of institutions.

This incoherence feeds confusion and frustration for students and parents. In high school, students are too often told to aim for a certain standard or course sequence, only to find that when they get to college, the criteria have changed.

And such experiences naturally most negatively affect families with less understanding of—and experience with—postsecondary education, as they of necessity must rely more heavily on the guidance provided by their local K–12 schools. High school counselors are on the front lines in helping students navigate this maze of high school graduation requirements, college admissions requirements, and placement standards. Yet these professionals carry heavy caseloads and must also provide a variety of other services.[25]

The Opportunities for Action

While the barriers we have described are not new and may thus feel intractable, we see opportunities for positive, achievable change.

Four opportunities in particular hold promise:

- Advanced quantitative literacy skills are increasingly in demand.
- Mathematics leaders are calling for modernizing mathematics pathways.
- Higher education innovations are expanding options, equity, and success.
- Innovations in K–12 systems are showing promise.

Opportunity #1: Advanced quantitative literacy skills are increasingly in demand.

Quantitative literacy is essential to democracy.

Mathematical literacy is increasingly important for informed participation in our democracy. As the world is transformed by explosive growth in access to large amounts of data, mathematical sensemaking has become fundamental to the healthy functioning of our society.[26]

Mathematical understanding can empower us to understand, critique, and play an active role in the world in which we live.[27]

Consequently, mathematical and quantitative literacy—critical thinking informed by sound mathematical and statistical reasoning—is ever more important for every individual, so that each of us can make informed decisions grounded in facts.[28]

New and expanding fields of work center on quantitative analysis and reasoning.

Our workplaces and our employment opportunities are also changing.

There are many new jobs[29] that specialize in working with data, such as positions in the data sciences (encompassing statistics, computer science, and domain-specific knowledge) and data analytics (the study of extracting information from data).[30]

Just as important, many existing fields, such as social work and nursing, are increasingly relying on data-driven analysis to inform research and decision making.[31]

As another example, *mathematical modeling*—defined as "a process that uses mathematics to represent, analyze, make predictions or otherwise provide insight into real-world phenomena"[32]—is an increasingly essential skill in many occupations.

Implications for Equity

New opportunities in education and the workforce must be available to all.

Business publications increasingly recognize and emphasize the importance of racial and cultural diversity to organizational and financial success.[33] Yet in science, technology, engineering, and mathematics (STEM) fields, Black and Latinx people are still underrepresented.[34]

Any new education paradigm must intentionally address these inequities in traditional STEM fields while also ensuring those inequities are not replicated in emerging fields.

Education systems should identify strategies that will develop a more diverse workforce in new mathematics-grounded subdisciplines.[35]

Mathematical modeling applies mathematics in a sequence of steps to solve practical problems in any context, including those contexts in which assumptions must be made and noted. It also entails communicating and justifying processes and findings.

The data sciences and mathematical modeling are good examples of mathematical disciplines that demonstrate the utility and applicability of mathematics outside of traditional STEM fields. These mathematical approaches are increasingly essential across numerous fields, including business operations, sociological studies, and healthcare management and implementation. Data sciences and mathematical modeling also thus lend themselves well to contextualized teaching and learning approaches, which may be more effective than traditional lecture-hall teaching.[36]

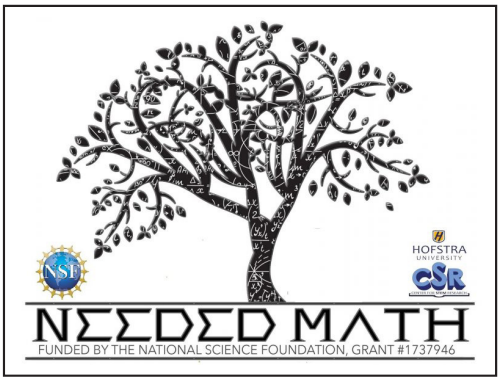
U. S. employers and studies on workforce needs report a lack of in-demand math skills.

In the last few years, many have sounded the alarm that U. S. employers are not finding the skills they are looking for in the labor market. Some reports cite a lack of general math skills.

For example, the 2015 Manufacturing Skills Gap survey of more than 450 manufacturing executives found a sizeable talent gap that is believed to be growing, resulting in millions of positions potentially going unfilled.[37] Math skills were noted as one of the most serious skill deficiencies, along with technical, computer, and problem-solving skills.

Other recent reports are more specific in citing the kinds of math skills that are increasingly in demand—such as mathematical modeling and statistical analysis—yet difficult to find in the U.S. labor force.

Employers who participated in the National Science Foundation–sponsored 2018 "Needed Math Conference" reported that the workers they hire for technician positions in STEM fields are not prepared with the skills needed to problem-solve on the job.[38] The mathematics problems typically found in textbooks often focus on one skill at a time and do not prepare students for the ill-defined and open-ended problems common in the workplace.



Contextualized instruction in modeling and statistical reasoning would teach these essential skills and better reflect the ways in which mathematics is used in contemporary workplaces—including defining problems, communicating about them, and collaborating to solve them.

In a survey conducted by the Society for Human Resource Management in 2018, human resources professionals reported that job candidates more often lack technical skills than soft skills.[39] Of the top three missing technical skills named by survey respondents, data science and data analysis skills came in second.[40]

A recent analysis of more than 150 million unique U.S. job postings since 2007 yielded 14 skills that have become "foundational" in the new economy; these skills include analyzing data, managing data, and communicating data. Jobs requiring these skills pay thousands of dollars more, on average, than those that do not.[41]

Other reports project that the number of job openings for individuals with data and analytics skills will increase significantly in the next few years, as these skills become "essential business tools"[42]—and that there will be a shortage of job-seekers with these skills.[43]

As experts have written, one job of higher education institutions is to "empower their students with employability—to determine what students "need to know to succeed in a postindustrial and globalized economy, culture, and political system." And, according to a large, nationally representative survey of U.S. adults, the majority (58%) said that their primary reason for pursuing higher education was to get a good job.[44]

In the United States today, higher education—from certificate programs to associates' degrees to postgraduate programs—is the gateway to most living-wage jobs.[45] And for most students, high school is the gateway to higher education.

The emergence of new applications for mathematical skillsets such as data analysis and mathematical modeling creates opportunity for students seeking access to meaningful and economically rewarding jobs. It also creates a challenge for mathematics educators to keep up with the rapid changes in workforce needs. The rapidly changing economy highlights the need for structures that support sharing workforce data in a timely manner and structures for effective data-sharing between education sectors and business and industry.

Opportunity #2: Mathematics leaders are calling for modernizing mathematics pathways.

Given the recognition that quantitative analysis skills have become increasingly essential to employability and active citizenship, we are seeing an emerging consensus that algebraically intensive courses, such as College Algebra, ought not to be the default requirement for all students. This shift in thinking has served to mobilize practitioners, professional organizations, and other leaders around modernizing mathematics pathways in both high school and higher education.

Mathematics professional associations across education sectors are speaking out.

National leaders in mathematics education are advocating for change. In 2011, in an article titled "Endless Algebra—the Deadly Pathway from High School Mathematics to College Mathematics,"[46] J. Michael Shaughnessy, then president of the National Council of Teachers of Mathematics (NCTM), asked (and answered):

> "(1) Is the 'layer cake' of algebra-dominated mathematics that pervades our U.S. secondary schools still relevant?
>
> "(2) Is calculus the be-all and end-all goal for the preparation of students for a successful transition to college?
>
> "My answer is, I think not."

Shaughnessy[47] recommended four mathematics transition paths, including statistical thinking and data analysis and probability.[48] And in 2018, the NCTM's influential *Catalyzing Change* report provided a detailed roadmap for moving away from the traditional high school mathematics sequence.

Implications for Equity

While changing course content cannot, on its own, advance equity, this period of course redesign creates an opportunity to develop new mathematics pathways with policies, structures, and practices that will lead to more equitable outcomes.

As Uri Treisman, Charles A. Dana Center executive director says,

"You cannot retrofit equity into inequitable structures. But when we design new structures, we have the opportunity to design with equity in mind."

Higher education mathematics professional associations—such as the Mathematical Association of America, the American Mathematical Association of Two-Year Colleges, the American Mathematical Society, the American Statistical Association, and the Society for Industrial and Applied Mathematics—have arrived at a similar conclusion about our algebra-dominated math curriculum.

In the 2015 publication *A Common Vision for Undergraduate Mathematical Sciences Programs in 2025*, these organizations stated that students are not well served by the traditional version of the college algebra course, and called for "mathematically substantive options for students who are not headed to calculus" that would focus on problem solving, modeling, statistics, and applications. New, multiple mathematics pathways should be created and aligned to students' intended fields of study.[49]

Neither we nor these professional associations are suggesting that students do not need algebra. Algebraic reasoning and basic algebraic skills are important foundations for many areas of mathematics, including data sciences and modeling.

Rather, we propose that educators should ask which algebraic content and skills are necessary for different pathways and programs, rather than using mathematics as a sorting mechanism for college and program entry. This approach includes reassessing the content and skills necessary for success in calculus and other advanced mathematics.

In modernized mathematics pathways, decisions on content should be based on evidence rather than on tradition.

Opportunity #3: Higher education innovations are increasing options, equity, and success.

The higher education sector has responded to the call to modernize mathematics content with widespread implementation of multiple mathematics pathways that offer differentiated, rigorous mathematics options tailored to students' academic and career goals.

These changes to mathematics course sequences aim not only to provide students with the quantitative skills needed for their chosen field and for informed participation in society, but also to ensure that arbitrary mathematics requirements do not block students' progress toward a credential.[50]

More institutions are offering multiple mathematics pathways.

Institutions of higher education are increasingly supporting students' entry into mathematics pathways aligned to programs of study rather than using College Algebra as the default requirement for all students.

As of fall 2015, 58% of community colleges across the U.S. reported implementing new mathematics course sequences,[51] and as of 2018, more than 15 states were broadly implementing mathematics pathways.[52]

The most common mathematics pathways include quantitative reasoning/literacy, statistics, and an algebra-based pathway for majors that require calculus.[53] Other pathways include technical mathematics, business mathematics, and mathematics for elementary educators.

Following are a few examples of changes in recent years:

- Nationally, enrollment in undergraduate statistics courses has risen, as has the number of statistics degrees conferred annually.[55]

Implications for Equity

Higher education institutions and systems must guard against creating new inequities in student access to these innovations.

Researchers found that colleges that implemented accelerated mathematics pathways on a small scale were more likely to enroll White students than Latinx students in the pathways.

Since the student success rates in the new pathways courses were higher than in traditional courses, this enrollment pattern limited the opportunity for Latinx students to succeed.[54]

- In Texas, all public community colleges and universities offer multiple mathematics pathways.[56] Some universities have removed college algebra from their core curriculum, meaning it does not count for general education credit.
- The University System of Georgia, Arizona State University, and others have removed college algebra requirements and are offering diverse mathematics options.[57]
- The Maryland Mathematics Reform Initiative is a collaboration between two- and four-year colleges and universities to design and implement multiple mathematics pathways that are relevant for students' chosen career paths.[58]
- A number of states, including Colorado, Arkansas, and Indiana, have made policy recommendations for aligning mathematics pathways to programs of study.[59]

The co-requisites strategy facilitates student progress through mathematics pathways.

The inception and expansion of mathematics pathways has created the opportunity to rethink how students enter into those pathways. Many entering college students have historically been required to take long developmental algebraic course sequences before beginning a college-level mathematics course.

Developmental education is common in all sectors of higher education, though it is more prevalent in community colleges.[60] Research published in 2009 found that in some institutions, more than half of incoming students were being placed in developmental mathematics courses, and that those students referred to such courses were unlikely to persist and complete a credential.[61]

There is now extensive evidence[62] that students are more successful if they are placed directly into a college-level course with appropriate supports. This practice is generally referred to as the *co-requisite model.* This body of evidence also shows that co-requisites, especially when combined with aligned mathematics pathways and placement reform, reduce equity gaps among students of color and students from low-income backgrounds.

Organizations such as the Charles A. Dana Center, the California Acceleration Project, Complete College America, and Carnegie Math Pathways all advocate for the implementation of co-requisite models in which the content of the supporting structure (e.g., course) is aligned to that of the college-level course.[63] An analysis of 2018 data from the Education Commission of the States found that 15 states recommended or mandated co-requisite reforms.[64]

More institutions of higher education are using a variety of measures for college placement.

Another important change in higher education is the increasing use of multiple measures for placement. Multiple measures may include a number of factors beyond a placement test—such as student performance in relevant high school coursework.

As of 2019, nineteen states had policies that either allowed or required the use of multiple measures.[65] Helping drive this change is evidence that high school performance is a much better predictor of future college success than are the results from standardized assessments.[66]

When Cuyamaca College in California began using high school performance for math placement, between 3 to 11 times more students of color were able to enter into college-level courses, depending on the course. Success rates in the courses held steady even with the inclusion of students who would have been previously considered "underprepared."[68]

Similarly, Long Beach Community College saw gains in access to and entry into transfer-level courses for all demographic groups once it began placing students in English and mathematics courses based broadly on their high school achievement (e.g., high school grade point average, last course in the subject, and grade in the discipline). Some of the largest relative gains were made by Latinx and Black students.[69]

These innovations are not yet the norm.

The structures and practices described above show great promise, but there is still work to be done. Many states and institutions have not yet implemented these new structures and practices. Others have made progress on initial implementation and still need to focus on improving quality, reaching full scale, and ensuring equitable outcomes.[70] Even those states and institutions of higher education that have made the most progress on implementing mathematics pathways are only just beginning to communicate with secondary schools about alignment. And thus far there have been few aligned changes to teacher preparation programs within those same institutions of higher education.

Implications for Equity

Mathematics pathways implemented with co-requisites and new placement practices have improved student success for students traditionally considered "underprepared" across demographic groups.[67] These findings call into question long-held preconceptions about postsecondary readiness and students' abilities.

For example, as noted earlier, college admissions standards often require Algebra II as a measure of general postsecondary readiness. It becomes difficult to defend this practice when students who do not meet this standard are shown to be successful in college.

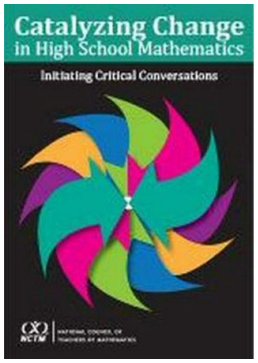
For too long, failure and inequitable outcomes have been accepted as the inevitable results of "deficits" in the students. It is now time to acknowledge the role that policies, practices, and structures play in hindering student success.

Many people are also asking how lessons from the successful implementation of co-requisites in higher education can be applied in the high school setting.

Opportunity #4: Innovations in K–12 systems are showing promise.

Efforts to create new mathematics pathways in higher education that are better aligned to students' future needs, including career opportunities, provide the K–12 sector with the opportunity to re-envision high school mathematics as well. We see innovative work and increasing collaboration across sectors in opening new mathematics pathways and creating better opportunities for students to demonstrate postsecondary readiness.

Educators are introducing new pathways and improved practices.



The National Council of Teachers of Mathematics aimed to stimulate efforts to create new pathways at the secondary level with its 2018 *Catalyzing Change* report, which recommended moving away from the traditional high school mathematics course sequence and instead developing courses that cover a list of essential concepts that all students should learn in high school. These concepts are grounded in the important topics of statistics and mathematical modeling.[71]

NCTM also advised that after the essential concepts are covered, students should choose a fourth-year mathematics course based on their personal and professional goals.

A 2019 report, *Branching Out: Designing High School Math Pathways for Equity*,[72] published by Just Equations, explored data demonstrating inequities in current mathematics pathways. The authors argued that offering "BRANCH" pathways leading to careers that do not require calculus would create more equitable opportunities for students.

At the state level, the Oregon Math Project is following many of these recommendations in redesigning the high school mathematics sequence to include a common two-credit core to provide the algebra, geometry, and statistics necessary for all students to be college and career ready. The core would be followed by a choice of Algebra II/Precalculus, Statistics/Modeling, or Applied Math/Modeling (the last of which would prepare students for technical careers). These choices would all be aligned to entry-level college mathematics courses. Also planned are fourth-year options including opportunities for dual (high school and college) credit mathematics.[73]

Some school districts are also initiating new courses and pathways. Center X at the University of California, Los Angeles, has developed an Introduction to Data

Implications for Equity

A new paradigm that prepares students for success in postsecondary pursuits and beyond must address institutional bias and inequities head-on.

In particular, tracking is a major concern.

Leaders in higher education, professional associations, and business and industry (among others) play an important role in signaling to teachers, parents, and students that all the pathways are valuable and rigorous.

The development of student supports that proactively help students explore options and expand their view of their own capabilities is as critical as the development of the pathways themselves.

Finally, tracking can be mitigated by establishing principles for how mathematics pathways should be implemented, accompanied by strong accountability measures to assess the level of equity in access to—and outcomes from—mathematics pathways.

Science course and is supporting its implementation in the Los Angeles Unified Schools.[74] There is also a growing call to teach computer science and coding across grades in K–12.[75] The extent to which this new curriculum can be clearly connected to mathematical curriculum—without supplanting it—will give both disciplines much more relevance to students.[76]

Escondido Union High School District in California has taken a systemic approach to "create mathematics experiences that use and build on the strengths of students and teachers."[77] This effort—which promotes a collective responsibility for student learning, de-tracks students and teachers, and provides intensive professional development for teachers—has led to increased student engagement and improved student outcomes.

Finally, equity-focused pedagogy has been shown to make a positive difference in student achievement.[78] The National Council of Teachers of Mathematics provides resources to support teachers in implementing classroom practices that support equity-based teaching.[79]

States are exploring policies that create new opportunities for students to demonstrate mathematics proficiency.

State policies on transition courses enable students to demonstrate postsecondary readiness through high school coursework without additional testing. These policies give students an additional option and provide them with the opportunity to earn the postsecondary readiness designation while in high school rather than as an additional step in the transition to college. These policies also increase opportunities for students and, in some cases, increase coherence across state institutions.

The Washington State Community and Technical Colleges system has an agreement that provides two consistent systemwide options for students to place into college-level mathematics courses: the high school Smarter Balanced assessment (coupled with specific high school course-taking) or passing a senior year transition course with a B- or better. Currently this agreement applies to all thirty-four institutions in the state's community and technical college system but to only one four-year institution, Eastern Washington University; the other public baccalaureate institutions have rejected the Smarter Balanced agreement but are currently considering whether to sign on to the transition course agreement.

Texas legislators took a different approach to using transition courses to designate postsecondary readiness. In 2013, the Texas Legislature passed House Bill 5 (HB 5),[80] which

provides a pathway to postsecondary readiness through transition courses. HB 5 requires that school districts work to establish agreements with at least one state institution of higher education to offer fourth-year courses that the institution will accept as a designation of postsecondary readiness.

This policy is laudable for requiring collaboration across the K–12 and higher education sectors and for creating avenues for students to achieve postsecondary readiness without additional testing. The approach, however, limits portability. As noted earlier, a student's postsecondary readiness designation will apply only to a small number of colleges—or sometimes to just one. The bill also led to the introduction of some high school mathematics pathways that are not well articulated to postsecondary pathways.[81]

Texas's HB 5 also provides a cautionary tale about unintended consequences. The bill changed the requirement for exit-level mathematics exams, which led unintentionally to a sharp decrease in the number of students—especially students of color and students from low-income backgrounds—being designated as college ready, merely because the students were no longer being tested in high school.[82] This problem was addressed with additional legislation in 2019. This experience demonstrates the need for careful assessment of the impact of new policies and practices.

Educators are collaborating across sectors.

We also see strong interest in engagement across sectors. Through the Dana Center's work to date with states to implement multiple mathematics pathways in higher education, nine states so far have used the opportunity to establish goals to increase alignment between higher education and K–12.[83]

In Maryland, the Kirwan Commission[84] interim report, published in 2019, is notable for the process through which it was developed—convening a variety of stakeholders within the state to wrestle with, and land on, new definitions and recommendations for improving the state's PreK–12 system to "perform at the level of the best-performing systems in the world."

In 2019, the Conference Board of the Mathematical Sciences offered a forum, High School to College Mathematics Pathways: Preparing Students for the Future,[85] to help states establish cross-sector steering committees to improve alignment and connections to the workforce. Response was so overwhelming that CBMS had to limit participation to 22 states and turned others away.

The dramatic increase in the numbers of students taking college courses in high school through dual enrollment is evidence of an ever more elastic boundary between high school and higher education. The National Center for Education Statistics reported that in the 2010–2011 academic year, more than 1.2 million students were enrolled in dual enrollment programs across two- and four-year institutions,[86] an increase of 80% from 2002 to 2003.[87]

There is disagreement as to whether this dual enrollment trend is entirely positive[88]—a discussion that is beyond the scope of this statement. Yet the large number of high school students who are simultaneously enrolled in college courses calls into question the perception that there is a clear boundary between high school and postsecondary education. Dual enrollment also illustrates the two sectors' shared responsibility for student success from high school into higher education. Dual enrollment creates an opportunity for high schools and institutions of higher education to communicate and collaborate—and to improve alignment. These efforts must also address equity gaps, given evidence that students of color do not have equitable access to dual enrollment opportunities.[89]

Conclusion: The Launch Years Call to Action

No student should face unnecessary obstacles in the transition from high school to postsecondary education.

Removing these obstacles is not easy—or we would already have done so.

We acknowledge, therefore, that the work ahead includes many challenges, including:

- **Removing outdated, irrelevant, and misaligned gatekeeper requirements** to college access and college completion;
- **Creating mathematics courses that prepare students** for programs, careers, and lives that require a range of mathematical skills; and
- **Monitoring student enrollment patterns and outcomes** to measure explicitly whether equity is being achieved.[90]

All students should leave high school prepared to engage in college-level mathematics aligned to their future goals—and ready to pursue, and succeed in, their chosen postsecondary pathway.

It is our collective responsibility, then, to:

- **Address systemic factors** that create obstacles to success and fuel inequity.
- **Ensure that our education systems help students expand their ideas** of what is possible and what they can achieve.
- **Enact new policies, structures, and practices** that make obsolete the student stories shared in this statement's introduction—and that instead propel students forward to successful futures.

Launch Years initiative

Taking Action on Launch Years: Recommendations

From the Launch Years Collaborative

Taking Action on Launch Years: Recommendations
from the Launch Years Collaborative

Introduction: The Launch Years Approach to Change

The Launch Years initiative envisions a future in which every student is supported to learn mathematics, sees mathematics as relevant to their life and goals, and is able to transition smoothly from secondary to postsecondary education—and then onward to meaningful careers, opportunities for upward mobility, and positive engagement in society.

This report begins with a call to action, "Why Launch Years? Why Now?" that details evidence showing that too many students are blocked from their dreams by misaligned and outdated mathematics requirements and policies.

The recommendations in this section offer concrete strategies that can be used to diversify mathematics pathways and establish policies, practices, and structures that enable students to transition seamlessly from secondary education to and through postsecondary education toward fulfilling careers and active participation in our data-driven society.

While we—the Launch Years collaborative and all who join us in this work—have challenges to overcome, we also see opportunity.

The challenge: Inequitable access to postsecondary opportunities contributes to growing inequality. Inequality is exacerbated by labor market demands for increasingly sophisticated mathematical knowledge and skills.

The opportunity: We can leverage these trends to drive creation of new pathways that enable students to excel as mathematical learners and to prepare for new applications of mathematics in their personal and professional lives.

This work has already begun. Hundreds of colleges and universities have established mathematics pathways, and tens of thousands of students are more engaged in learning meaningful mathematics and experiencing increased success.

Many of the strategies described in what follows are also being tested through nascent regional efforts to create stronger connections between higher education, school districts, and workforce and industry.

Now is the time to build upon this foundational work and establish a new paradigm that will ensure access and success for all students,

Postsecondary options are as diverse as the students they serve.

The Launch Years initiative recognizes that students have a wide array of choices for education beyond high school, including apprenticeships, certificates, two- and four-year degrees, and education opportunities within the military.

All these options are worthy pursuits, and all are included under the broad umbrella of ***postsecondary education*** in this and related Launch Years literature.

While not all students matriculate directly from high school into postsecondary education, the Launch Years initiative's primary goal is to increase the number and diversity of students making that transition. Data show that postsecondary education provides the greatest opportunity for upward social and economic mobility.

At the same time, these recommendations will also benefit students who enter directly from high school into the workforce by establishing high school mathematics pathways that are better aligned with labor market needs—and that better prepare them to continue their education at a later date.

especially those who have not experienced success within traditional education systems. Developing the infrastructure to achieve such access and success is a complex endeavor.

Here we present seven recommendations, with supporting strategies, to provide a comprehensive, cross-sector road map for improving the all-important transition from secondary to postsecondary mathematics. As a part of our commitment to equity, we wish to be transparent about how we expect Launch Years strategies to increase equitable outcomes. Therefore, each recommendation is followed by a brief summary of the ways in which these changes will increase equity.

What do we need to change?

- **Recommendation 1:** Secondary and postsecondary institutions offer multiple effective and aligned mathematics pathways.
- **Recommendation 2:** Postsecondary institutions and other providers prepare preservice and in-service teachers to teach multiple mathematics pathways.
- **Recommendation 3:** Education institutions offer robust supports to help students navigate mathematics pathways, maximize learning, and access broader postsecondary options.
- **Recommendation 4:** Business and industry partners actively inform the design of education opportunities that support students' goals.

How do we bring change to scale?

- **Recommendation 5:** State agencies and education systems develop policies that enable smooth student transitions from secondary to postsecondary mathematics.
- **Recommendation 6:** State agencies and education systems, institutions, and schools build a strong shared understanding of and commitment to—goals among their constituents.

How will we measure impact and improve?

- **Recommendation 7:** State agencies, systems, and institutions use data and research to measure impact and to inform continuous improvement of mathematics pathways.

About the Launch Years Collaborative and These Recommendations

In 2018, the Charles A. Dana Center at The University of Texas at Austin began mobilizing individuals and organizations to advance the Launch Years work. We informally refer to this coalition as the ***Launch Years collaborative***.

A core component of this collaborative is the Launch Years Consensus Panel, which includes leaders representing K–12 and higher education, state governance, business and industry, research, and equity advocacy.

In 2019, the Panel helped develop these recommendations for establishing a new vision for students' launch years—the transition from high school mathematics to postsecondary success. The Panel also developed a Call to Action that explains why the Launch Years initiative is needed at this time.

See the full list of Consensus Panel members at https://www.utdanacenter.org/our-work/k-12-education/launch-years/launch-years-consensus-panel.

What do we need to change?

Recommendation 1: Secondary and postsecondary institutions offer multiple effective and aligned mathematics pathways.

The Vision: All students learn mathematics that is relevant and applicable to their future lives. Student learning experiences are aligned across the transition from secondary to postsecondary education and careers, and they are designed based on a common set of expectations for quality in course design, curricular supports, and instruction.

Strategy 1a: State agencies, postsecondary education systems, and institutions modernize mathematics pathways.

Postsecondary institutions modernize the curriculum by offering multiple ***mathematics pathways**** that are aligned and relevant to students' future aspirations—and that propel students to upward economic and social mobility.

Business and industry partners—and data—inform the development of the pathways. Postsecondary institutions actively engage with secondary partners to maintain a two-way flow of information and to collaborate on pathways alignment.

These pathways situate statistics, quantitative reasoning, and/or computational thinking alongside pathways that prepare for calculus.

The postsecondary mathematics pathways enable students to complete, within one academic year or less, a college-level gateway mathematics course that aligns to their academic and career goals. Postsecondary institutions also

- Avoid relying solely on algebraically intensive placement tests, and instead place students using a multiple-measures placement strategy that includes high school grade point average (GPA).
- Offer ***co-requisite*** support for all gateway-level mathematics courses.
- Promote research-based instructional practices, including those that focus specifically on advancing equitable outcomes.

Strategy 1b: Secondary education systems collaborate with postsecondary partners to offer aligned mathematics pathways.

Secondary systems develop and adopt course sequences for all third- and fourth-year high school students that situate statistics, quantitative reasoning, and/or computational thinking alongside sequences that prepare students for calculus. These course sequences are aligned to students' postsecondary and career goals.

The third- and fourth-year course sequences are designed in partnership with postsecondary institutions at the state, regional, or local level to align with modern higher education mathematics pathways and to support students' attainment of their long-term goals.

These course sequences include a third-year course at a level equivalent to that of Algebra II designed to prepare students for advanced courses other than Calculus. Equivalence does

*For this and other words or phrases with this formatting, see the brief glossary at the end of these recommendations for more information.

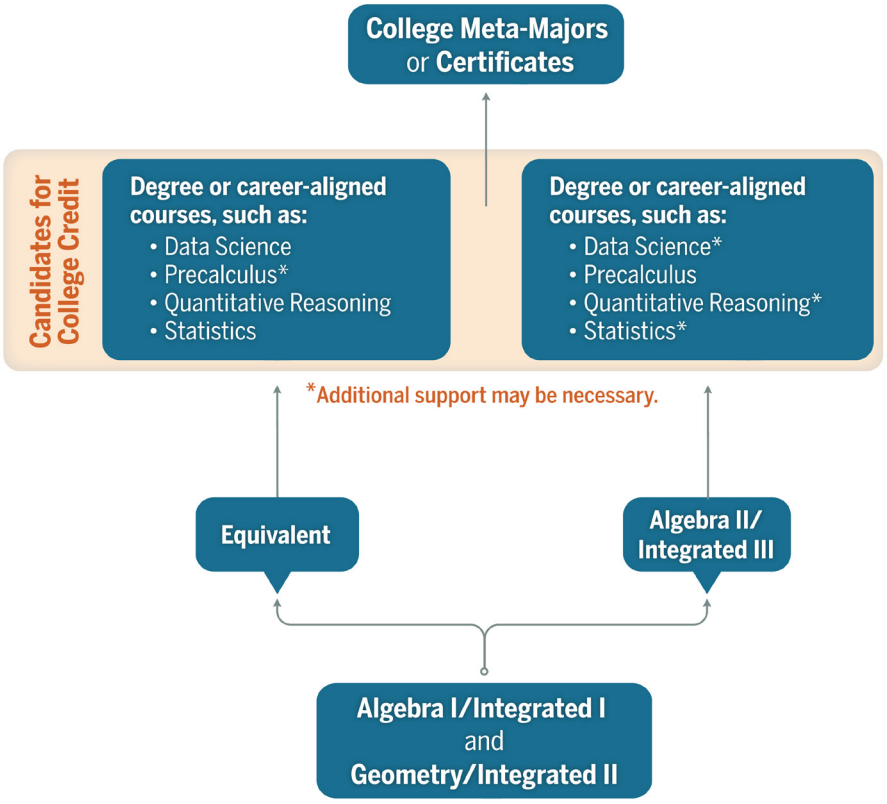
not imply a one-to-one correspondence with existing state standards for Algebra II. Rather, cross-sector teams develop a definition ofAlgebra II equivalence based on the preparation required for a seamless transition from high school to postsecondary education.

This third-year alternative to Algebra II requires prerequisite core algebraic expertise, but the course itself is not a mere subset of typical Algebra II content. Rather than focusing on the development of algebraic manipulations in preparation for Calculus, such a third-year alternative

- Focuses on sense-making, authentic use and modeling, data analysis, computational thinking, and functions to reason through and tackle unfamiliar problems and to prepare for higher-level future work.
- Requires students to make decisions based on analysis of messy, uncertain situations.
- Includes challenging, meaningful, and relevant tasks, some of which require the use of technological tools.
- Emphasizes the importance, relevance, and application of mathematics for solving real-world problems. That is, the course teaches students to understand important mathematics deeply. Rather than increasing the mathematical complexity by taking students through more and more abstract and disconnected manipulations, the course teaches application of mathematical concepts in increasingly complex situations.

These third- and fourth-year high school mathematics courses articulate with each other so students can apply and advance their skills and understandings year after year. Just as a Precalculus course in the fourth year of high school follows from a third-year Algebra II course and articulates to a calculus pathway, the alternative to Algebra II would be situated in a comparable pathway. For example, an introductory Data Science course in the fourth year would follow from the third-year alternative to Algebra II, and it would also articulate to a data science pathway in higher education.

Figure: Possible course progression pathways



As these third-year high school courses are designed to connect to specific follow-on courses, each course will naturally include important content that is not in the other courses. Given this reality, support is provided to students to enable their movement from Algebra II to one of the nonalgebraic fourth-year courses (e.g., Quantitative Reasoning, Statistics, or Data Science) or from the alternative to Algebra II that moves to Precalculus. Such support might be made available through the development of bridge modules or through just-in-time additional instruction within the course.

As high schools and higher education institutions begin multiyear efforts to align their curricula, it is important to meet the needs of current students moving between the sectors while these new pathways are still being developed and implemented. It is especially important not to lose sight of those students who need additional support *now* to be ready for college-level mathematics.

In the short term, to address the needs of this population of students, high schools collaborate with postsecondary partners to create and adopt a yearlong transition mathematics course for fourth-year high school students. A twelfth-grade mathematics transition course ensures that students meet a ***postsecondary readiness*** measure by the end of their senior year and that they are prepared for the most common entry-level credit-bearing college mathematics courses, such as College Algebra, Statistics, or Quantitative Reasoning.

Strategy 1c: Secondary and postsecondary education systems adopt or develop mathematics course design frameworks that define expectations for quality.

Each of the courses at the secondary and postsecondary levels is grounded in a framework that clearly defines course expectations for content and context, including major concepts, learning and performance tasks, and instructional practices.

These frameworks include

- A description of how each course leads to postsecondary pathways;
- Clearly articulated major mathematics concepts, with descriptions of how these concepts are tied to proficiency and descriptions of the skills needed to apply those concepts;
- Instructor guidance on ensuring student understanding and on teaching how to apply the mathematics concepts;
- Design principles that emphasize active learning, productive struggle, problem-solving, communication, interdisciplinary connections in authentic contexts, the use of technology, and other instructional practices that support learning in a culturally and linguistically diverse environment;
- Expectations for integrating mathematical content with learning sciences content on mindsets—including concepts such as self-efficacy, help-seeking, and perseverance—that has been demonstrated to increase academic achievement and to positively affect future employability and earning potential; and
- Descriptions of the types of tasks that students should experience in the course, including mathematical tasks that challenge students to use higher-order thinking skills to engage with the complexity of real contexts and open-ended problems.

Course design and implementation is consistent with the goal, purpose, expectations, and clientele, and design allows sufficient flexibility to attend to individual situations

and needs. People building and implementing the courses are equipped with tools for understanding the courses and course needs, such as

- Optimizing implementation of lesson cycles,
- Recognizing that planning happens beyond the lesson level,
- Considering approaches for teacher preparation, and
- Recommending methods for assessment.

Given the changing quantitative demands for full participation in the workforce—and in life, as consumers and citizens—there is no way to predict how long current and upcoming pathways will remain viable options for students. To ensure that pathways do not become obsolete, the K–12 sector collaborates with business, industry, and postsecondary partners to regularly review the relevance of course content and to continue smoothing the transition across education sectors and on into the workforce.

How does Recommendation 1 increase equity through course design?

- Defining expectations for high-quality course design is a first step to ensuring that each student has access to high-quality courses.
- The expectations for course design build awareness and support implementation of practices that lead to more equitable and improved outcomes.

Recommendation 2: Postsecondary institutions and other providers prepare preservice and in-service teachers to teach multiple mathematics pathways.

The Vision: All students learn from teachers who are well prepared and well supported to teach the mathematics content in the various pathways. These teachers are fluent in instructional practices that support academic and social-emotional development—and that meet the needs of a diverse student population.

Strategy 2a: Preservice programs incorporate emerging effective practices in mathematics pathways.

Postsecondary teacher preparation coursework and practice prepares teachers to

- Teach mathematics in multiple mathematics pathways, with explicit attention to statistical and quantitative reasoning, computational thinking, and authentic modeling. Attaining this goal requires redesigning programs rather than merely adding content to existing courses.
- Use strategies for teaching in culturally and linguistically diverse classrooms. Such preparation includes techniques that yield equitable outcomes for students (e.g., cultural relevance, real-world mathematics applications, reflecting, noticing, and engaging in the classroom community), learning strategies to support on-track/on-time student progress, and engaging in faculty and administration collaboration to ensure equitable outcomes.
- Integrate into daily instruction both academic content *and* learning sciences content on mindsets—including concepts such as self-efficacy, help-seeking, and perseverance—that are demonstrated to increase academic achievement.

Strategy 2b: In-service teachers and faculty receive ongoing support to implement, improve, and sustain mathematics pathways.

In-service teachers and faculty also require professional learning and resources to teach new content and improve instructional practices (as described for preservice teachers in Strategy 2a). Support for in-service practitioners includes resources on effective practices for teaching in culturally and linguistically diverse classrooms and strategies for integrating research on learning mindsets with academic content.

K–12 and postsecondary institutions and mathematics departments understand that these mathematics pathways must continue to evolve to address changing needs, and they create plans to support ongoing professional learning to meet these needs. High school and postsecondary mathematics departments establish structures that support a culture of shared learning and continuous improvement.

Strategy 2c: Secondary, postsecondary, and business and industry sectors collaborate to create innovative solutions to teacher shortages.

Secondary and postsecondary agencies and institutions collaborate to ensure that all students receive instruction from qualified teachers and faculty. The teachers and faculty reflect the diversity of the communities they serve.

Solving teacher shortage issues will require innovative approaches—both in recruiting new teachers and in supporting in-practice teachers and faculty based on local needs and resources.

States, K–12 districts, and postsecondary institutions collaborate to implement evidence-based strategies to recruit and retain more teachers and faculty of color and to develop talent within communities experiencing teacher shortages. Such strategies include

- Building supportive on-ramps into the profession through school district–university partnerships.
- Developing "grow your own" teacher preparation programs that encourage students to become teachers in their own communities.
- Providing alternatives to licensure requirements that allow for multiple ways to demonstrate competency to become a teacher.

Innovations for supporting teachers and faculty in offering new content may include using technology to pair content experts with instruction experts. For example, distance learning models may draw upon content experts in the private and nonprofit sectors, who can work in collaboration with local teachers to provide instruction. Similarly, secondary

and postsecondary institutions may develop regional partnerships to train and support teachers and faculty.

State agencies support innovation through testing new models, building networks, and clearing potential policy obstacles. Business and industry play a role in identifying solutions, providing content expertise, and investing expertise and resources as appropriate.

How does Recommendation 2 increase equity through supports for preservice and in-service teachers?

- Teachers trained to teach in culturally and linguistically diverse classrooms are better prepared to meet the individual needs of each student.
- Teachers and faculty who represent the diversity of the communities in which they work amplify the voices of those communities in education decision-making and in establishing the culture of education institutions. These individuals also serve as role models who can help students see themselves and their communities reflected in the education system.

Recommendation 3: Education institutions offer robust supports to help students navigate mathematics pathways, maximize learning, and access broader postsecondary options.

The Vision: All students are routinely supported to develop their full potential as mathematical learners. Routines and structures help students and their families understand and navigate education systems, especially at critical decision and transition points.

Strategy 3a: Students receive high-quality support to promote learning and academic success in mathematics.

Secondary and postsecondary institutions provide supports that proactively help students develop the study skills, critical thinking skills, and resourcefulness required to succeed in mathematics. Institutions encourage participation by showing students and families the value of the supports. Support programs include evaluation plans that examine which students are served, the effectiveness of those services, and the effectiveness of strategies used to engage students.

- Academic supports for learning mathematics—such as tutoring, academic coaching, and supplemental instruction—are critical for enabling the success of all students. Education institutions generally provide these supports in person, virtually, and/or via computer application. In addition, supports embedded within mathematics classes can provide much needed just-in-time assistance for students working to understand concepts.
- In addition to students who draw on scaffolding supports to learn course material, there are many students who need or desire a greater challenge or enrichment to extend their learning. These students greatly benefit from engaging with higher-level mathematics content and engaging in experiences that accelerate their understanding and enrich their experiences in mathematics.

- Structured peer-to-peer programs, such as learning communities, support students in building relationships and collaborative skills—useful for learning mathematics—in and out of the classroom. Learning communities create connections for groups of students who share academic goals and interests—and who take many of the same courses. Peer-to-peer programs help students build a sense of community and belonging inside and outside of classes.

Learning mathematics is a cultural activity that involves the acquisition not only of knowledge, but of attitudes, beliefs, and norms. As with any cultural activity, such acquisition happens through relationships between individuals. Relationships between students, among students and teachers, and among students and other school professionals all contribute to student learning and success. Learning supports are most effective when they promote not only academic learning, but also strategies for building these positive relationships.

Strategy 3b: Students receive comprehensive advising to help guide them to the appropriate mathematics pathway that aligns with their postsecondary interests.

Students understand the mathematics pathways options available to them, how those pathways align with postsecondary options, and how to prepare for the suite of courses they will need to successfully achieve their education and career goals.

- Beginning in middle school, teachers and counselors help students understand and explore options, and they advise students on the various mathematics pathways and how the pathways connect to postsecondary options. Continuing in high school and college, students develop a deeper understanding of their opportunities and are able to make informed decisions on which mathematics pathway to pursue. Students understand the benefits and limitations of each pathway—and how to bridge to another pathway if their interests change.
- A range of partners, including secondary and postsecondary institutions, business and industry representatives, and community organizations, focus on increasing the numbers of students of color and from low-income backgrounds who pursue postsecondary options in science, technology, engineering, and mathematics (STEM) fields by removing or redesigning structures, policies, and practices that have not served these populations well.

High school and college faculty and other student services professionals also advise students formally and informally. All these individuals are well prepared with accurate information and knowledge of best practices in advising.

Strategy 3c: Institutions provide supports to help students explore career options, set goals, and understand how to access postsecondary options.

High schools collaborate with postsecondary partners, as well as partners from business and industry, to provide students with academic advising, career exploration, and college counseling, as well as programs to help set goals and map out individualized plans for achieving those goals. Students continually assess how mathematics pathways support their college and career interests. These supports help students navigate the decision points in the last two years of high school and prepare for their transition to postsecondary education.

All stakeholders associated with secondary and postsecondary support programs actively guard against allowing biases to prejudice the manner or direction in which students are guided. Student entry into, and progress through, pathways should not be influenced by

biases about who "can" or "should" do certain mathematics subjects or levels, or about who belongs in particular academic or career fields. Nor should negative perceptions about mathematics be communicated to students. Mathematics pathways, and the structures and practices associated with them, should be designed to eliminate tracking and implicit and explicit bias and to take actions to address problems quickly.

Students and their families have access to a robust set of supports to help them make decisions about their futures.

- College counseling is available to every student to help them (1) identify institutions that suit their needs, (2) understand the application process, (3) compile high-quality applications, and (4) begin to understand what to expect upon matriculation. College counselors are mindful of the needs of students who may have less support or guidance outside school and who thus may need more support to achieve their goals. While high schools may be primarily responsible for offering such services, postsecondary institutions are partners in ensuring that high school counselors and teachers have accurate, up-to-date information about institutional processes and requirements.
- Postsecondary institutions and business and industry work with their secondary partners to offer programs and networks—such as campus and workplace visits, mentorships, summer college or work experience programs, and new student orientations—to help students explore career and education options and to support students' smooth transition to postsecondary education.
- *Near-peers*, peers who may be slightly older students or recent alumni, use their experiences to help others navigate decision and transition points such as applying to postsecondary institutions and matriculating to, and progressing through, college. Institutions train such near-peer students and provide support to help them develop an understanding of advising and counseling techniques as well as how to draw on their knowledge and experiences to guide their peers.

The strategies in Recommendation 3 require that student services professionals at both the secondary level and the postsecondary level are included as full partners in mathematics pathways implementation and that they receive support that enables them to fulfill their critical role in effective and equitable implementation.

How does Recommendation 3 increase equity through student supports?

- Robust supports provide each student the opportunity to succeed academically, explore and understand options, and make informed decisions. These include mechanisms to support the participation and success of historically underrepresented groups in STEM fields.
- Intentional processes identify and rectify tracking and bias in student supports.

Recommendation 4: Business and industry partners actively inform the design of education opportunities that support students' goals.

The Vision: All students see connections between their learning experiences and their aspirations for rewarding jobs and careers. Student learning exposes them to authentic and accurate information and experiences to help them understand the relevance of mathematical concepts to careers—and to make knowledgeable decisions about their futures.

Strategy 4a: Secondary and postsecondary education systems leverage cross-sector partnerships to inform mathematics pathways with data from labor markets.

The development and quality review processes for high school and higher education pathways are anchored to international, national, state, and regional labor market information regarding high-skill, high-wage, and in-demand careers.

Historical enrollment patterns cannot on their own drive the availability of pathways. Instead, periodic review of labor market information related to employer demand should be a factor in evaluating, revising, and incentivizing ***career pathways***.

The design of mathematics pathways is integrated into systemwide conversations about the overall academic pathways through high school and postsecondary education and into the workforce. States and local districts and institutions define pathways to include the expectation that students will be exposed to a continuum of opportunities that range from building career awareness to more immersive and experiential work-based learning.

State agencies and systems enhance alignment and opportunities for meaningful collaboration with sector partners—including secondary, postsecondary, and business and industry. This collaboration informs and guides efforts within each sector, including aligning pathways to in-demand jobs. The discussions include those who are leading the development and implementation of the Perkins and Workforce and Innovation Opportunity Act plans in order for the state to move toward a coherent vision of student readiness for postsecondary education and careers.

These cross-sector discussions include identifying the quantitative skills necessary for the future workforce in key industries. Stakeholders establish structures to ensure that the mathematics courses in the respective ***meta-majors***, pathways, and programs of study leading to careers in these key businesses and industries actually prepare students with the necessary skills.

Secondary education uses intentional communication and engagement strategies for classroom educators, guidance counselors, and school administrators, as well as for students and families, to build awareness of new mathematics pathways and to share information about the career opportunities that can follow from the various pathways. These strategies include case-making materials for diverse audiences.

Strategy 4b: Business, industry, and education sectors increase work-based learning opportunities—and provide supporting materials—for educators and students.

Educators receive supports that enable them to integrate information about mathematics in the workplace into their instruction.

- Educators have access to high-quality instructional materials along with training on the materials' use.
- Professional learning exposes mathematics and career and technical educators to mathematics in the workplace through structures such as externships and job shadowing.
- State agencies and systems proactively promote access and participation in these initiatives, with particular attention to educators who are working with traditionally marginalized and underrepresented students, including English language learners, students with disabilities, and students from low-income backgrounds.

Students have access to high-quality ***work-based learning*** internship and apprenticeship experiences at both the secondary and the postsecondary levels. These experiences help students, especially those who have been marginalized by race or income level, to explore high-wage, high-skill, in-demand careers. Concurrent mathematical learning and application deepens understanding of the mathematics and prepares students for the workplace.

- States develop specific strategies to expand access, participation, and success in work-based learning for students who are traditionally marginalized and underrepresented, including students of color, English language learners, students with disabilities, and students from low-income backgrounds.
- State agencies, systems, school districts, and other institutions engage with business and industry partners to discuss their role in this process and to provide work-based learning opportunities to students in high school and the first year of college. This work includes understanding what supports workplace partners need to be able to design and implement high-quality opportunities for students.

Strategy 4c: Researchers and leaders regularly collect and use data to refine measures of "relevant mathematics."

Researchers, state agencies, and postsecondary partners work with business and industry leaders to update definitions and improve data-collection efforts to understand demand for specific domains of quantitative knowledge and skills.

- Researchers explore long-term trends of mathematics pathways, including examining and closing inequitable outcomes, student/employee success on the job, and other targeted research questions.
- Employers provide examples of tasks that use mathematical skills and reasoning that can be embedded into instruction.

How does Recommendation 4 increase equity through collaboration with business and industry partners?

- Strategies to connect mathematics learning and instruction with applications in the workforce increase opportunities for marginalized and underrepresented student populations to engage in relevant mathematics that lead to success in high-demand, high-wage jobs and careers.
- Researchers draw on long-term labor market data to address inequitable outcomes.

How do we bring change to scale?

Recommendation 5: State agencies and education systems develop policies that enable smooth student transitions from secondary to postsecondary mathematics.

The Vision: All students experience secondary and postsecondary mathematics courses as part of an intentional and seamless pathway that leads to a clear goal. This smooth progression is made possible by policies and structures that align mathematics pathways across sectors and that create a clear road map for students. Any requirements students must meet are grounded in evidence and designed to lead to equitable outcomes. The policy environment supports innovation and accountability leading to equitable outcomes.

Strategy 5a: States promote advanced mathematics course-taking.

States pass policies that require students to take at least one advanced mathematics course beyond Geometry or Integrated Mathematics II that will prepare them to demonstrate postsecondary readiness. Advanced mathematics courses prepare students for one or more of the following: statistics, data science, quantitative reasoning, or calculus. To support student success, state agencies also establish and monitor indicators of student progress through high school coursework (on-track and on-time indicators).

States and state agencies employ multiple levers to support students to enroll and succeed in rigorous fourth-year high school mathematics courses. In particular, states ensure that every high school has the resources to offer viable fourth-year mathematics course options. State agencies monitor enrollments and outcomes in third- and fourth-year advanced courses to ensure equitable participation, as demonstrated by enrollments and outcomes among various student populations that are proportional to a school's student demographics.

Strategy 5b: State agencies and education systems create policies that support cross-sector alignment of mathematics pathways.

State agencies, school districts, postsecondary institutions, and business and industry collaborate to ensure that mathematics courses create clearly articulated and aligned pathways that propel students from high school to postsecondary education and ultimately to high-wage, high-skill, and in-demand jobs.

Specifically, states, districts, and postsecondary institutions implement policies and promote strategies to scale mathematics course pathways in the last two years of high school that align

- with postsecondary readiness and placement, and with the range of mathematics content in the first postsecondary-level course requirement, *and*
- with each student's chosen meta-major or program, career pathway, or other indicator of their highest aspirations for their career field, *and*
- with regional, state, national, and international labor market demands.

Policies that are relevant to such alignment include graduation requirements, dual-credit course-taking agreements, and postsecondary readiness measures—as well as associated

accountability structures and structures for student assessment, admissions, and placement.

Finally, pathways intended for two- and four-year degrees should align across postsecondary institutions so that students are able to predictably and effectively transfer and apply mathematics credits to a degree across institutions without increasing debt and time-to-degree-completion.

Strategy 5c: State agencies and education systems implement policies that support a coherent system for demonstrating postsecondary readiness.

The definition of *postsecondary readiness* that enables students to enter directly into an entry-level college mathematics course is as consistent as possible across similar institutions. Where this definition varies across institutions, comprehensive and accurate information is easily accessible to help counselors, advisors, students, and families understand and navigate the readiness requirements. Further, students are able to demonstrate postsecondary readiness in mathematics (and placement into a college-level course) through multiple options, including

- Successful completion of a twelfth-grade mathematics transition course (as described in Strategy 1b) aimed at preparing students for the range of entry-level postsecondary mathematics courses.
- Use of evidence-based measures that include high school course completion and GPA.

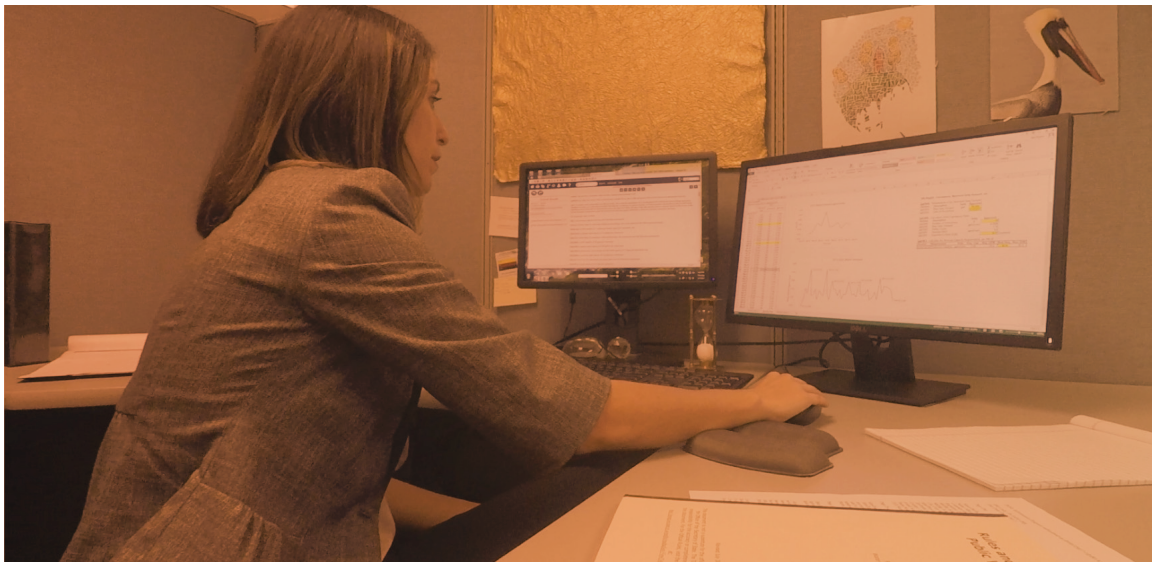
When assessments are used to determine postsecondary readiness, students can take these assessments for no cost within the high school setting. High schools prepare students for the assessments, and students and families are given information about how the assessments will be used. The assessments test the range of algebraically-intensive and non-algebraically-intensive content aligned with entry-level college mathematics courses.

Strategy 5d: Postsecondary leaders ensure their admissions policies place equal value on all mathematics pathways.

Institutions of higher education admissions policies, practices, and requirements promote advanced mathematics course-taking in high school that is aligned with higher education mathematics pathways. These practices and requirements do not specify or privilege a particular mathematics course, such as Algebra II, as required for admissions. Grades or other demonstrations of learning are considered in admissions alongside scores on standardized mathematics assessments.

How does Recommendation 5 increase equity through policy?

- Policies and supports from states ensure that each student has access to advanced mathematics courses.
- Increasing alignment and coherence between high school and postsecondary institutions removes barriers that disproportionately affect first-generation students and students from high schools with fewer student supports.
- Multiple avenues to demonstrate postsecondary readiness create more opportunities for students and help address bias in standardized testing.



Recommendation 6: State agencies and education systems, institutions, and schools build a strong shared understanding of—and commitment to—goals among their constituents.

The Vision: All students and their families receive coherent, consistent, and accurate information regarding the mathematics pathways progression that will help them set aspirational goals for their futures. This progression is made possible by leaders effectively inspiring and mobilizing their constituents around a shared vision of student success.

Strategy 6a: Leaders establish a common language for communicating about efforts to improve the transition from secondary to postsecondary mathematics.

Leaders intentionally and strategically develop and use a common language that will communicate to the many stakeholders who have roles in supporting student transitions from secondary to postsecondary mathematics. This common language accounts for different levels of understanding of mathematics, of policies and practices across sectors, and of the broader systemic challenges to be addressed. Critical to that language is a recognition that all stakeholders have an important role in improving students' education experiences, learning, and outcomes.

In developing a common language, it is important to understand and mitigate against situations in which terminology and language use become barriers to communication. Such mitigation includes

- Clarifying terminology that has different meanings in different settings.
- Surfacing and defining terms—including abbreviations, acronyms, and initialisms—that are specialized to specific settings.
- Noting terminology and language usages that trigger unintended reactions among certain audiences.

Representatives of the diverse set of stakeholders responsible for implementation of—and served by—the mathematics pathways are included in planning strategies, developing and reviewing communications tools, and facilitating communications and engagement.

Strategy 6b: Leaders use communications and engagement strategies to inspire and mobilize diverse constituents.

Leaders mobilize a diverse group of stakeholders to collaborate over time to achieve and sustain deep systemic changes. For successful mobilization, people must connect the changes to their values, understand the context for the changes, recognize the benefits for the larger community, take ownership and responsibility for the change, and commit to productive action. In addressing the transition from secondary to postsecondary mathematics, people must also work across sectors and roles.

An important strategic decision is whether to frame the work on the secondary-to-postsecondary transition as part of existing efforts or as a new initiative or strategy. This decision depends on local context. For some audiences, it is effective to present the work as building upon previous successes. For others, it can be more effective to mobilize constituents with a new idea to emphasize that the status quo is not acceptable.

Effects of successful mobilization efforts include

- **Making the case:** People understand the reasons for change, including the data that demonstrate the failings of the current system and the evidence for the proposed changes. While data and evidence are key to the rationale for change, they are presented so that people also understand the negative effects of the current system and possible benefits of the change for individual students.
- **Building commitment:** Leaders and institutions commit to systemic and sustained change. People are more likely to commit when they have the opportunity to engage with and process ideas and to give input on strategies. Input can be by proxy—for example, leaders of a faculty association may represent faculty interests. Finally, people are more likely to commit when there is transparency about how decisions are made.
- **Fostering collaboration:** Mobilization activities support effective, purposeful collaboration across stakeholder groups and sectors (secondary, postsecondary, business and industry, research, and others). These activities result in visible products or measurable outcomes that will build understanding and support collaboration. For example, high school mathematics teachers, postsecondary mathematics faculty, and business leaders collaborate to create a map of pathways from high school to postsecondary opportunities—and into high-wage, high-skill, and in-demand jobs.
- **Inspiring action:** People respond to clear information about actions that can be taken. Effective communication around action steps provides specific direction and information about supports and deadlines, while also including a process for reporting and accountability.

One challenge of mobilization is inviting engaged participation while at the same time setting clear expectations for action once decisions have been made.

Overly prescriptive communications are likely to create resentment if people feel they are "just being told what to do." Vague or inconsistent communications lead to confusion and frustration. Effective, well-planned communications and engagement activities

- Explain the decision-making process and the rationale behind decisions. People who had a role in the process serve an important role as visible advocates.

- Find ways that people can actively engage with information about decisions. For example, offer opportunities to learn about and discuss the data supporting the change or to hear student or educator stories about their experiences with similar changes.
- Identify the areas in which people can contribute their expertise. Communications are framed to help empower people to take appropriate action in their sphere. For example, a policy on course outcomes may be decided at the state level, but local teachers still have an important leadership role in designing courses at their own schools.

Strategy 6c: Leaders ensure that communications equitably inform and engage diverse populations.

An equitable communications plan informs and engages diverse audiences and includes diverse voices. *Diverse* in this context means populations representing different races, economic statuses, languages, abilities/disabilities, and geographical regions, as well as a broad set of stakeholder groups across sectors and roles.

An equitable communications plan should intentionally address equity in (at least) these five areas:

- **Dissemination and engagement:** The plan identifies platforms and methods of communication that will reach, and speak to, different audiences.
- **Messaging:** The plan sets principles for the use of asset-based language. Terminology should be appropriate to the audience.
- **Languages:** Communications may need to be provided in multilingual formats.
- **Accessibility:** Communications are designed and delivered for maximum accessibility—for example, creating documents that can be read by assistive technology and including closed-captioning for videos and full transcripts for audio and video communications.
- **Stakeholder concerns:** The plan identifies and addresses the priorities and concerns of different populations and groups.

How does Recommendation 6 increase equity through engagement, communication, and mobilization?

- A strong, transparent mobilization plan helps ensure consistent and equitable implementation across districts and institutions of higher education.
- Well-planned and transparent communications and engagement strategies reflect diverse voices and perspectives and speak to diverse audiences and perspectives.

How will we measure impact and improve?

Recommendation 7: State agencies, systems, and institutions use data and research to measure impact and to inform continuous improvement of mathematics pathways.

The Vision: All students are supported by systems that routinely use findings from data to understand and improve students' learning, progress, and experiences as they navigate through secondary and postsecondary mathematics pathways and on into the workforce.

Strategy 7a: State agencies and systems establish and use shared success metrics.

State agency and system leaders define, communicate, and implement key qualitative and quantitative success metrics to drive policy and practice alignment across the K–12, higher education, and workforce sectors. Success metrics are based on common definitions of goals and are aimed at improving equitable access and outcomes in mathematics education.

Quantitative success metrics

Short-, intermediate-, and long-term milestones are used as quantitative metrics to assess progress and impact of each full mathematics pathway to and through postsecondary education and into the workforce. Examples of quantitative success metrics include

- **Student learning** outcomes, such as grades on early and final course assessments, measures of postsecondary readiness, and completion of college-level mathematics course(s) aligned to a program in the first year of postsecondary enrollment.
- **Student mindset development** metrics, such as self-efficacy, sense of belonging, self-regulation, productive struggle, and growth mindsets, especially as they relate to goal-setting, help-seeking behaviors, and learning mathematics.
- **Student progression** measures, such as high school graduation, postsecondary matriculation, time-to-completion of a degree or credential, entry into the workforce, and wages at first job.
- **Pathways implementation** indicators, such as alignment of secondary mathematics pathways to postsecondary program requirements; access to, and success in, different mathematics pathways; and proportional representation of demographic groups in the pathways.

Qualitative success metrics

Qualitative data capture the student experience in and through mathematics pathways. These data reveal how students understand the mathematics pathways in their education system and how students access information. Qualitative data also show how students access—and are provided—opportunities and how they are considered successful. Examples of qualitative metrics include

- **Students' experiences within the pathways,** such as engagement in learning, identities as mathematical learners, and sense of belonging.
- **Students' experiences navigating across the pathways** such as experiences with advising and student access to relevant, timely, and actionable information

about mathematics pathways; how students make decisions about selecting or switching pathways.

Strategy 7b: State agencies and education systems implement intentionally equity-focused evaluation processes.

Leaders implement evaluation processes to ensure equitable and high-quality outcomes for all students. Data systems are designed to collect a common set of student-level demographic data including at least race/ethnicity, gender, socioeconomic status, and the intersection of these variables. States build and maintain the capacity to support schools, institutions, and agencies in using data effectively, identifying disparities across subpopulations, and targeting actions to achieve more equitable outcomes.

This capacity enables researchers, system leaders, and practitioners to assess and make progress on equity goals. Specifically, disaggregated data are used to

- Target supports and resources to identified subpopulations, and not simply to call out so-called performance gaps.
- Guard against tracking and other inequities by assessing whether participation—and success in—various mathematics pathways is equitable.
- Identify and replicate practices that lead to equitable and high-quality outcomes.

Strategy 7c: States use their data systems to track student progress across sectors.

States, agencies, and systems develop nimble processes that respond to changing quantitative needs. Timely information and feedback loops at all levels identify what is—and is not—working in mathematics pathways. Disaggregated data flow across K–12, higher education, and the workforce to identify how well the pathways serve students as they progress. This data flow is facilitated by interstate data-sharing structures such as those provided by the National Student Clearinghouse.

- States use longitudinal student data systems to track progress as students move across the secondary, postsecondary, and workforce sectors. Leaders connect timely, reliable student-level data from across sectors to monitor and evaluate progress on goals.
- State agencies, systems, and institutions establish secure data-sharing agreements across education sectors as permitted by the Family Educational Rights and Privacy Act (FERPA). Data are used to inform student support strategies, improve communication and advising efforts, and identify successful programs and practices. Data analyses are public and transparent, are reported in aggregated and disaggregated forms, and are intentionally used to inform students, families, and communities.
- Secondary education systems report data that tie enrollment in high school mathematics courses and participation in career pathways to student graduation rates and transitions into postsecondary pathways. System reporting includes information on the proportions of participating students by demographic groups, for the purpose of assessing whether student access and success in mathematics pathways is equitable.
- Higher education institutions report data on the percentages of students enrolled and successful in gateway mathematics courses, on student learning attainment, and on student transitions into the workforce. These institutions report information on the

proportions of participating students by demographic groups, to show whether student access and success is equitable across groups.

- Postsecondary and secondary quantitative access and success data, and qualitative data about students' experiences navigating systems and institutions, are triangulated by state leaders to understand students' comprehensive education experiences and to target supports and resources where they are most needed.
- Leaders triangulate education data with workforce data, including specific analyses of employment shortages by industry, wage growth and advancement opportunities, and employee preparation, to inform program development and to provide information for students to inform decision-making.

The Launch Years collaborative believes that this report presents a strong case for taking action on these recommendations. We must collectively commit to transforming mathematics education in the United States so that every student, in every school, can access—and succeed in—a first-class mathematics education that will propel them to bright futures.

How does Recommendation 7 increase equity through the use of data and research?

- The intentional use of disaggregated data to identify supports and replicate practices that lead to more equitable and improved outcomes moves beyond a focus on "achievement gaps."
- Transparency of data analyses empowers students, families, and communities to contribute to the discussion about their experiences, outcomes, and improvements.

Glossary

Career pathways include all educational disciplines and educational levels from apprenticeship through doctoral degrees. *Career pathways* is not intended to describe only career and technical education (CTE) in high school or technical programs in higher education. The term *career pathways* encompasses all pathways to a career.

Co-requisite, as in *co-requisite* supports or models, refers to the practice of placing students who are identified as being underprepared directly into college-level courses upon enrollment. The students are provided with additional learning support through various structures such as concurrent courses, labs, or tutoring sessions. This approach contrasts with *prerequisite* models, in which students are required to take developmental or remedial courses before entering into a college-level course.

A ***mathematics pathway*** refers to the series of mathematics courses that students take to complete requirements for an academic goal such as high school graduation or completion of a postsecondary program, certificate, or degree. The Launch Years initiative specifically promotes the concept that educators should align mathematics pathways across secondary and postsecondary education. A *high-quality* mathematics pathway offers students a coherent and consistent learning experience that supports their development as independent mathematical learners and is aligned with their academic and career goals.

A ***meta-major*** is a cluster of academic majors with related content and disciplinary focus, often sharing a common set of general education or introductory courses. An example of a meta-major is social sciences. Many colleges and universities establish a suite of meta-majors to help students pick an academic focus upon matriculation even if they are not ready to select a specific major. Associated terms include *guided pathways* and *structured pathways*.

Postsecondary readiness refers to the knowledge and skills students need to succeed in a variety of postsecondary education options. The Launch Years collaborative uses *postsecondary readiness* in place of the more commonly used *college readiness* to make it clear that there are many postsecondary options beyond colleges and universities, including certifications, apprenticeships, and education options in the military.

Work-based learning links classroom instruction with structured experiences in a workplace to enhance learning and develop employability skills.

Launch Years initiative

Launch Years State Profiles

Georgia: A Fertile Environment for Change

Launch Years
State Profiles

Conditions within the K–12 and higher education sectors in Georgia have converged to create an opportunity to focus on the transition from secondary to postsecondary mathematics.

On the K–12 side, the Georgia Department of Education (GaDOE) has been an early leader in implementing transition courses to help students prepare for postsecondary education. Both the Technical College System of Georgia (TCSG) and the University System of Georgia (USG) were partners in this effort. Now that this solid foundation has been established, the GaDOE sees the opportunity to focus on improvement and refinement of course options.

In recent years, the USG has been engaged in a number of dramatic structural and programmatic changes. The system has invested heavily in establishing and aligning mathematics pathways, reforming placement practices, and improving supports for students. Until recently, this work has largely been focused within the state's university system. USG leaders believe that now the time is right to align this work with that of their K–12 counterparts.

Richard Woods, Georgia State School Superintendent, agrees that the time is right for deep cross-sector collaboration. He says,

> "The Georgia Department of Education is committed to strong mathematics teaching and learning, and working hand-in-hand with our partners in higher education to support continuous improvement. We are honored to be selected to participate in the Launch Years Initiative and look forward to working collaboratively with the University System of Georgia and Technical College System of Georgia to ensure students are prepared to pursue further educational opportunities after high school. Working together, we can pursue child-focused and classroom-centered policies that will move mathematics education forward, to the benefit of Georgia's students."

These fertile conditions for change, in addition to the structures that support collaboration between the GaDOE, the USG, and the TCSG, are described in more detail below.

Innovation in High School Mathematics Courses

The GaDOE has expanded the number of mathematics options that can be used for high school graduation credit, and the department is committed to equitable student access to the broad array of courses. Two of these mathematics course options—*College Readiness Mathematics (CRM)* and *Technical College Readiness Mathematics (TCRM)*—are college transition courses designed to support students preparing for postsecondary options offered in Georgia.

"The Georgia Department of Education is committed to strong mathematics teaching and learning, and working hand-in-hand with our partners in higher education to support continuous improvement."

Richard Woods,
Georgia State School Superintendent

College Readiness Mathematics is a fourth-year transition course option for students who have completed three years of mathematics in high school, but who have not yet met high school mathematics standards essential for success in first-year postsecondary mathematics courses. The CRM course has been approved by the University System of Georgia as a fourth mathematics course beyond Algebra II or Advanced Algebra for non-STEM (science, technology, engineering, and mathematics) majors.

The ***Technical College Readiness Mathematics*** course is designed to meet the needs of students who intend to enroll in a technical college program. The TCRM course can be taken after—or concurrently with—Geometry in the second or third year of high school.

The GaDOE sees the Launch Years work as an opportunity to build upon the success of the initial implementation of these transition courses and to engage stakeholders in a continuous improvement process. The GaDOE looks forward to exploring how transition courses can prepare students to pursue any mathematics learning pathway. This commitment to continuous improvement was a primary factor in Georgia's selection to participate in the Launch Years initiative.

Ambitious and Deep Reforms Underway in Higher Education

The University System of Georgia has garnered support from prominent national initiatives—support that has strengthened the system's work and spurred implementation of mathematics pathways in Georgia colleges and universities. Complete College Georgia is a cross-sector collaborative effort to increase the number of postsecondary degrees and certificates awarded in the state; this collaboration has driven a number of reforms in mathematics. The USG is a Strong Start to Finish grantee; this USG work also supports mathematics pathways work to increase college completion in Georgia.

In 2013, the USG established a systemwide Mathematics Task Force to address the role of mathematics in college completion. Among other things, the Task Force recommended the improvement and redesign of lower division mathematics courses and instruction, and the Task Force stated that college algebra should not be the default mathematics course for non-STEM majors.

Subsequently, the University System of Georgia adopted a Momentum Year Approach for all its institutions. This approach is based on research showing that certain freshman-year actions—such as completing gateway mathematics courses and following clearly sequenced coursework—are associated with degree progress and completion. Momentum Year elements are being implemented in all USG institutions; this work includes the creation of program maps that outline the sequence of courses—including the appropriate mathematics courses—needed for each degree.

A key aspect of the Momentum Years is that all USG remedial mathematics courses are delivered using a *co-requisite model*, meaning that students who are assessed as being underprepared enroll directly in the appropriate college-credit course and receive additional support through a variety of structures. This reform has resulted in dramatic increases in the number and percentage of students completing college-level mathematics courses across the general population and in all subpopulations in the state.*

Structure for Cross-Sector Collaboration and Policy Recommendations

The GaDOE convenes a State Mathematics Advisory Council made up of administrators, classroom teachers, community members, business and industry partners, representatives from higher education entities, and K–12 mathematics leaders. This advisory body enables cross-sector discussions and creates an

*https://sites.nationalacademies.org/cs/groups/dbassesite/documents/webpage/dbasse_191879.pdf

efficient mechanism for making policy recommendations. In addition, the USG has developed and grown a standard Policy Review Process that has streamlined review and provided for replacement of legacy policies that were stifling rapid transformation.

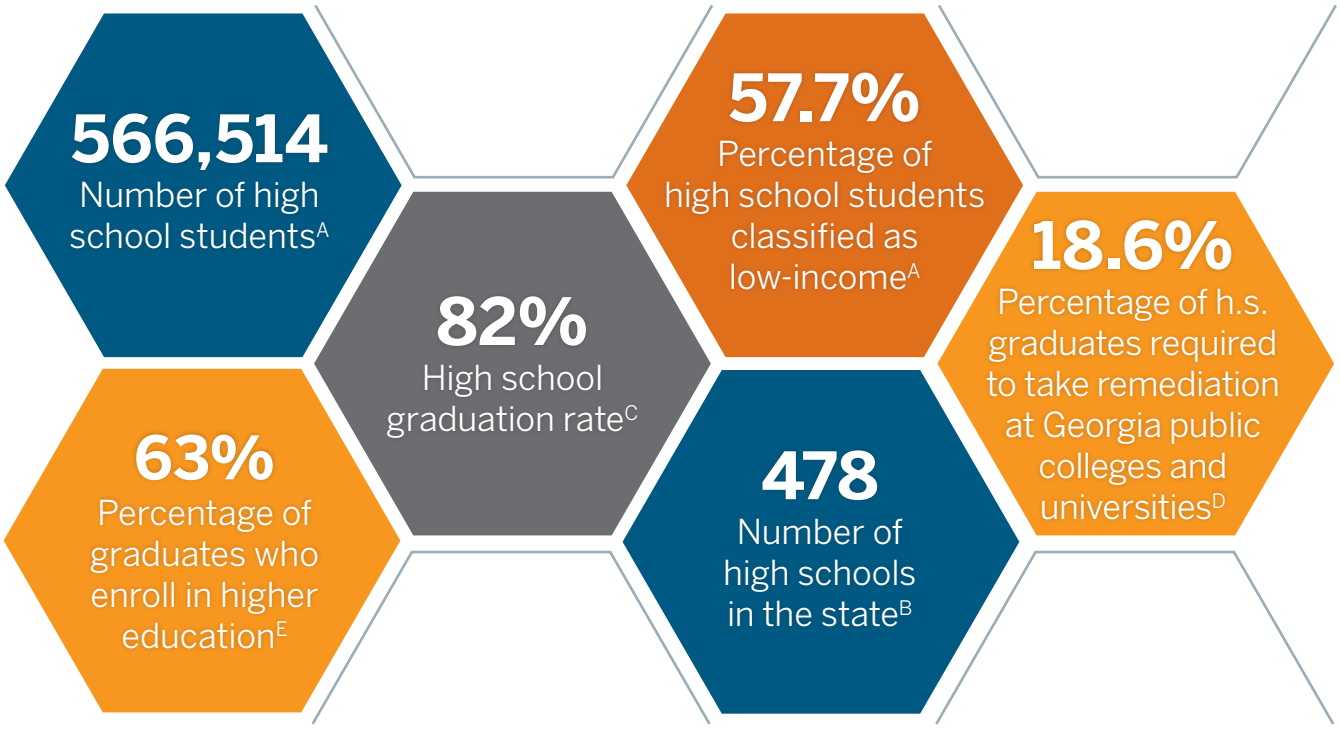
Georgia Education Governance and Organizational Structures

Agency	Description
GaDOE: Georgia Department of Education	Led by the state's School Superintendent, the GaDOE has the authority to administer public school laws.
Georgia SBOE: Georgia State Board of Education	The Georgia SBOE is the state rulemaking body for K–12 education.
TCSG: State Board of the Technical College System of Georgia	The State Board of the TCSG establishes the standards, regulations, and policies for the 22 colleges within the system.
USG: Board of Regents of the University System of Georgia	The USG Board of Regents determines rules and policies for the 26 institutions in the system.
Governor's Office of Student Achievement	The Governor's Office of Student Achievement is the state's P–20 (prekindergarten through college graduation) education agency, which provides policy and research support to the governor in collaboration with all of the state's other education agencies.

State of Georgia Education Policy Snapshot

Mathematics credits required for graduation	4 credits
Algebra II requirement	Mandatory for high school graduation.
Admission to credit-bearing courses in community and technical colleges	Mathematics course placement is determined by students' scores on college entry assessments such as SAT, ACT, Accuplacer, or PSAT.
Admission to public baccalaureate institutions	The 4 mathematics units of the USG's Required High School Curriculum (RHSC) must include a minimum of Algebra I/Coordinate Algebra, Geometry/Analytic Geometry, Algebra II/Advanced Algebra, and a 4th unit of advanced mathematics from a list of approved courses.
College placement	All entering USG students are placed into college-level mathematics; students are identified as needing co-requisite support based on a number of criteria, including high school grade point average and assessment scores.

Georgia Student Numbers



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[B] Georgia Department of Education. (2019). School Count by Type. https://oraapp.doe.k12.ga.us/ows-bin/owa/fte_pack_school_count.entry_form

[C] High school graduating class of 2019. Georgia defines a graduate as a student who leaves high school with a Regular Diploma (this does not include Certificates of Attendance or Special Education Diplomas) in the standard time (4 years). This is a 4-year Cohort graduation rate. The Governor's Office of Student Achievement. K–12 Report Card. https://gosa.georgia.gov/report-card-dashboards-data/report-card

[D] High school graduating class of 2017. The Governor's Office of Student Achievement. High School Graduate Outcomes Report. https://hsgrad.gosa.ga.gov

[E] High school graduating class of 2017. No data was available for 15% of the class. The Governor's Office of Student Achievement. High School Graduate Outcomes Report. https://hsgrad.gosa.ga.gov

Texas: Opportunities in Policy and Practice

Launch Years
State Profiles

As the first state to implement mathematics pathways in higher education broadly and deeply, Texas is well positioned to be in the vanguard of the Launch Years work. Deep cross-sector collaboration on mathematics pathways is already underway in several regions of the state. Recent legislative actions, coupled with these regional efforts, provide a supportive context for extending the implementation of mathematics pathways into high schools. A few of the elements paving the way for Launch Years work in Texas are summarized below.

Innovation in High School Mathematics Courses and Requirements

While taking four years of mathematics is not currently compulsory for the state's default graduation requirement, the Foundation High School Program, all students begin high school on the "Foundation + Endorsement" graduation plan. State law requires Texas high school students to declare and take coursework to fulfill an *endorsement*—a broad area of concentration, such as business and industry, or public services, when choosing ninth-grade coursework. Earning an endorsement requires a fourth credit of mathematics, and the recommended mathematics courses are those that are most relevant to the endorsement areas. Students must get parental permission to opt out of the endorsement if they fail to meet endorsement requirements by the end of high school.

In 2013, legislation also required that local school districts partner with at least one institution of higher education to develop and offer mathematics college preparatory courses, often called transition courses, for high school seniors who have not yet shown college readiness. Students who successfully complete the course are exempt from being required to take remediation courses and may enroll in a college-level mathematics course in the partnering higher education institution. (The legislation specifies that students must enroll in such a course during their first year of college.) Thus, these courses are an alternative way for students to demonstrate college readiness before high school graduation.

Progress in Developing Higher Education Mathematics Pathways

Work on mathematics pathways was launched in Texas in 2012 as a collaborative endeavor between the Charles A. Dana Center at The University of Texas at Austin and the Texas Association of Community Colleges (TACC). As of 2016, all fifty community college districts in Texas—and many universities—had joined the effort. The initial work focused on redesigning developmental and gateway mathematics to shorten course sequences and align pathways to programs of study.

This work led to a number of tangible outcomes. The Texas Higher Education Coordinating Board (THECB) made policy changes to allow colleges to differentiate placement for different mathematics pathways. Every public university and college in Texas now offers at least two mathematics pathways, and most offer three or more. Several universities removed College Algebra from their core curriculum, meaning the course could not be used for general education credit. Most importantly, data show an increase in the number of entering students who completed a gateway mathematics course in their first year of college.

New Emphasis on Cross-Sector Collaboration

The legislative mandate for college preparatory courses has brought about significant cross-sector collaboration around the mathematics content and pedagogy needed for postsecondary readiness.

A mathematics task forced convened by the Texas Association of Community Colleges' Texas Success Center (TSC), composed of college and high school mathematics faculty, created a framework of student learning objectives for a "HB 5 College Preparatory Math Content"* course as an optional resource for districts. The learning objectives were back-mapped from a range of entry college-level mathematics courses. In addition to common algebra topics, the TSC framework includes probabilistic and quantitative reasoning outcomes and mathematical process standards such as communication and problem-solving.

The TSC framework is not used uniformly across the state. Some districts and colleges have taken a local or regional approach to implementation of college-preparatory courses. Thus, the courses offered vary widely across the state

Regional Work Supports Collaboration

Texas institutions of higher education, school districts, and organizations have initiated a number of regional efforts across the state to promote collaboration on mathematics education across the secondary and postsecondary sectors.

From 2016 to 2018, three regions worked with the Dana Center to implement a College Prep Mathematics course, Texas's transition-to-college-mathematics course, aligned to the Texas Success Center framework of student learning objectives. This effort involved eight higher education institutions and more than 30 school districts in Central Texas, the Houston and Gulf Coast region, and the Corpus Christi region.

Colleges and universities in West and East Texas also began regional outreach to their K–12 partners as part of their work with the Dana Center to implement mathematics pathways in 2018. Twenty institutions of higher education and 18 school districts participated in events to share information about the pathways and create plans for ongoing coordination.

Central Texas mathematics leaders, at the request of college presidents and superintendents, formed the Central Texas Mathematics Alignment Taskforce (CTXMAT) in 2018 with the support of the E3 Alliance and the Dana Center. This group was charged with improving alignment of mathematics content in the latter years of high school with the content of gateway college mathematics courses—and with addressing related policies and practices.

The CTXMAT released a set of recommendations in September 2018 to fulfill their charge. Since that time, the taskforce has worked on alignment of mathematics to programs of study, developing assessment tasks, and working with the Texas Higher Education Coordinating Board to align placement instruments and policies with mathematics pathways.

*HB 5 refers to House Bill 5, legislation passed in the 2013 regular session of the Texas Legislature.

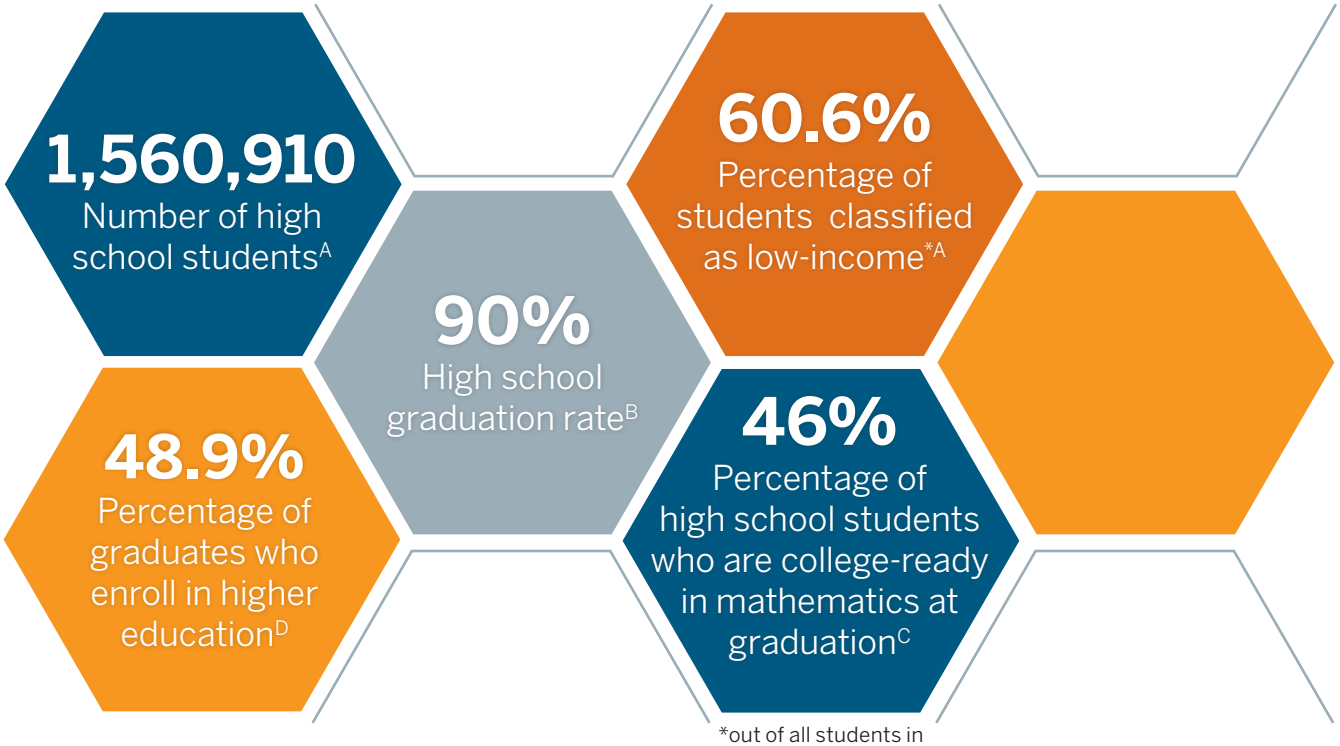
Texas Education Governance and Organizational Structures

Agency	Description
TEA: Texas Education Agency	Oversees primary and secondary education for more than 1,200 school districts and is headed by the commissioner of education.
SBOE: State Board of Education	Composed of 15 elected members who determine policies and standards such as graduation requirements.
THECB: Texas Higher Education Coordinating Board	Composed of 9 members appointed by the governor, the THECB provides leadership and coordination for higher education across the state; it also develops and implements higher education policy.
TACC: Texas Association of Community Colleges	TACC is a nongovernmental organization that represents the state's 50 community college districts and is home to the Texas Success Center (TSC), which supports improved practice and student outcomes in community colleges.

State of Texas Education Policy Snapshot

Mathematics credits required for graduation	3 credits of mathematics required for the default Foundation High School Program diploma. A fourth year of mathematics is required, however, as part of diploma endorsements (see below) and for a distinguished diploma.
Algebra II requirement	Not required for the default Foundation High School Program diploma. However, students who take four years of mathematics that includes Algebra II earn a distinguished diploma.
Admission to credit-bearing courses in community and technical colleges	All incoming college students are required to take the Texas Success Initiative Assessment (TSIA) unless they have a waiver in the form of specified ACT or SAT scores. Completion of a college preparatory course also counts as a waiver at the partnering higher education institution. TSIA scores determine placement in community college courses.
Admission to public baccalaureate institutions	Students must have earned an endorsement diploma, and have either graduated in the top 10% (or for the flagship University of Texas at Austin, in the top 6%) of their public high school class or submit an ACT and/or SAT score that satisfies the institution's benchmark for these exams. Some institutions require a distinguished designation on the diploma in addition to an endorsement.
College placement	Students who pass the Texas Success Initiative Assessment are considered college-ready at every higher education institution in the state.
Other relevant policies	House Bill 5 (HB 5, passed in the 2013 regular session of the Texas Legislature) requires students to earn diploma endorsements; students choose from among five broad areas of study, each of which includes recommended applicable fourth-year mathematics courses. The law also requires school districts to partner with institutions of higher education to develop and provide college preparatory mathematics courses for seniors who have not yet demonstrated college readiness.

Texas Student Numbers



*out of all students in grades K through 12

Sources for student data

[A] 2018–2019. Texas Education Agency. Texas Academic Performance Report: 2018-19 State Student Information. https://rptsvr1.tea.texas.gov/cgi/sas/broker?_service=marykay&_debug=0&single=N&batch=N&app=PUBLIC&ptype=H&_program=perfrept.perfmast.sas&level=state&search=distnum&namenum=&prgopt=2019/tapr/student.sas

[B] High school graduating class of 2018. This is a 4-year cohort graduation rate for students who first attended ninth grade in 2014–15. They are followed through their expected graduation with the Class of 2018. Texas Education Agency. Texas Academic Performance Report: 2018-19 State Attendance, Graduation, and Dropout Rates. https://rptsvr1.tea.texas.gov/cgi/sas/broker?_service=marykay&_debug=0&single=N&batch=N&app=PUBLIC&ptype=H&_program=perfrept.perfmast.sas&level=state&search=distnum&namenum=&prgopt=2019/tapr/attendgrad.sas

[C] High school graduating class of 2018. Texas Education Agency. Texas Academic Performance Report: 2018–19 State College, Career, and Military Readiness (CCMR). https://rptsvr1.tea.texas.gov/cgi/sas/broker?_service=marykay&_debug=0&single=N&batch=N&app=PUBLIC&ptype=H&_program=perfrept.perfmast.sas&level=state&search=distnum&namenum=&prgopt=2019/tapr/ccmr.sas

[D] High school graduates enrolling in higher education in fall of 2018. 21.8% enroll in public four-year institutions, 23.7% enroll in public two-year institutions, and 3.4% enroll in private institutions. Texas Higher Education Coordinating Board. Texas Higher Education Data. High School Graduates Enrolled in Higher Education. http://www.txhighereddata.org/index.cfm?objectId=77D62E90-D970-11E8-BB650050560100A9

Washington:
A Culture of Innovation

Launch Years
State Profiles

The state of Washington has demonstrated a commitment—through a long history of policy initiatives and projects—to improving student learning and success in mathematics across secondary and postsecondary education. These efforts have addressed high school, community college, and university mathematics curricula, pathways, and completion requirements.

Many of these projects have supported deep cross-sector collaboration. This culture of innovation has been strengthened by an explicit focus on equity.

A few of the most recent efforts that have laid the foundation for the state's engagement in the Launch Years initiative are summarized below.

Innovation in High School Mathematics Courses

Bridge to College Mathematics is Washington State's senior-year high school transition course that offers an alternative path to postsecondary readiness for students who score below the college-ready threshold on the high school state assessment. The course was adapted from the Southern Regional Education Board's Math Ready course through a collaborative effort among Washington State high school and higher education faculty. In the 2018–2019 academic year, this course was taught in 188 high schools across 111 school districts in the state. House Bill 1599, passed in 2019, establishes that completion of this course counts for the graduation pathways requirement.

Modeling Our World with Mathematics was developed recently under the Office of Superintendent of Public Instruction's (OSPI) leadership to provide a rigorous alternative third credit of mathematics for students who have previously struggled with mathematics. The course, designed around thematic units to contextualize the mathematics, is intended to follow geometry and to strengthen students' skills for additional course-taking in mathematics.

Progress in Developing Higher Education Mathematics Pathways

Mathematics Pathways to Completion was a three-year initiative in which the Washington State Board for Community and Technical Colleges collaborated with the Charles A. Dana Center at The University of Texas at Austin to implement higher education mathematics pathways. The project involved 2-year and 4-year institutions across Washington. The work continues and is being integrated into the guided pathways initiative being implemented across the state's entire community and technical college system.

The majority of Washington higher education institutionsnow offer multiple college-level mathematics pathways (at least three and up to five) for students, and these pathways are explicitly referenced in the statewide Direct Transfer Agreement (DTA) for 2-year and 4-year institutions.

> "While we have made progress in reducing barriers to flexible math pathways, the next giant step must include a coordinated and unflinching commitment to eliminating the narrow and inequitable vision of math pathways."
>
> **Chris Reykdal**,
> Superintendent of
> Public Instruction

History of Cross-Sector Collaboration

Despite having no formal state-level cross-sector coordinating body, Washington has a history of state and regional K–16 collaboration, especially in the area of mathematics. This collaboration is exemplified in the development of the *Bridge to College Mathematics* transition course. Another example is the Successful Transitions to College project (2014–2017) that facilitated cross-sector action research projects among mathematics administrators, faculty, and teachers from Eastern Washington University, the Community Colleges of Spokane, and seven area school districts.

And, recently, Washington participated in the 2019 Conference Board of the Mathematical Sciences (CBMS) Pathways Forum, which convened state leaders working to coordinate mathematics reform efforts from grade 11 through the second year of college. The CBMS Forum's goal was to help states create policies and practices for mathematics instruction that address three main issues: 1) the changing role of math in the economy; 2) college readiness; and 3) articulating the mathematical pathways that will serve all students. The leadership team that attended the CBMS Forum will lead Washington's state-level Launch Years efforts.

Commitment to Equity

The Office of Superintendent of Public Instruction's (OSPI) equity definition* charges education leaders to "examine the ways current policies and practices result in disparate outcomes for our students" and to "actively dismantle systemic barriers, replacing them with policies and practices that ensure all students have access to the instruction and support they need to succeed in our schools."

Washington Education Governance and Organizational Structures

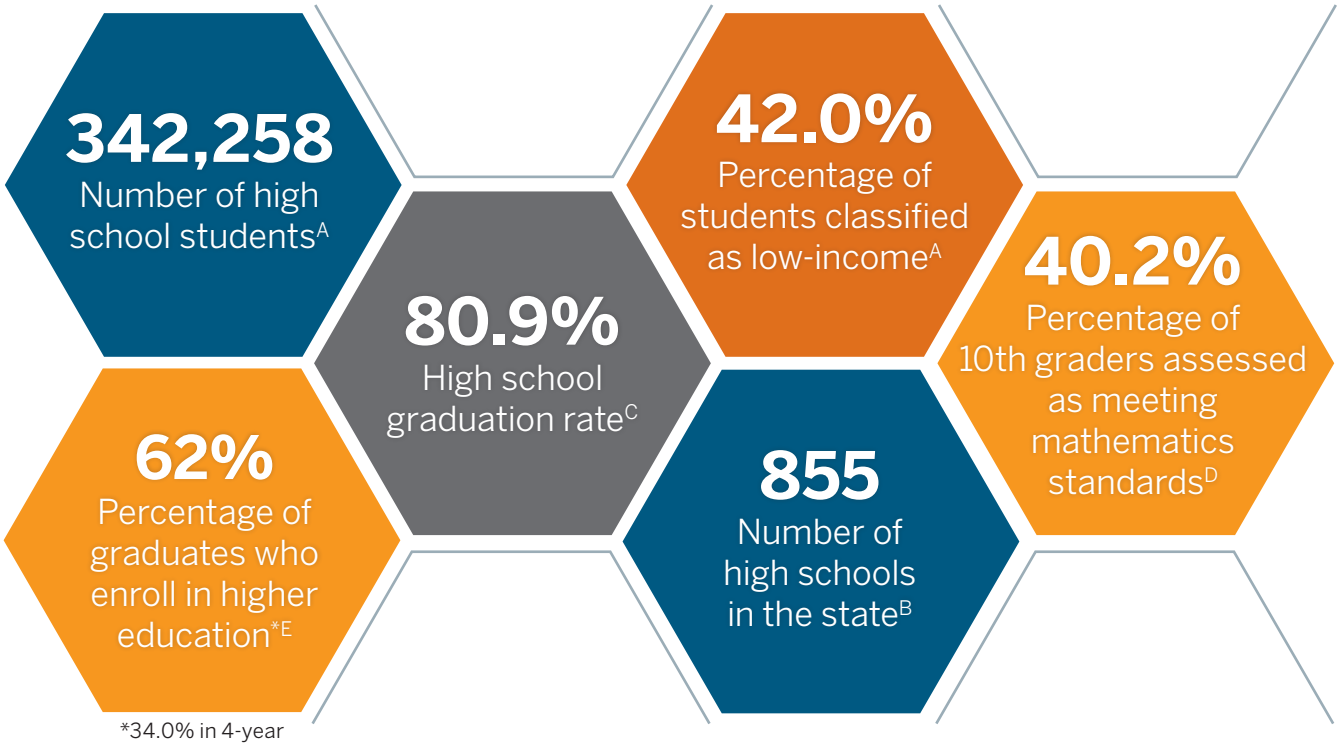
Agency	Description
OSPI: Office of Superintendent of Public Instruction	Oversees the state's 295 public school districts and 6 state-tribal education compact schools
SBE: Washington State Board of Education	Responsible for K–12 policymaking and accountability oversight
SBCTC: Washington State Board for Community and Technical Colleges	Coordinates and directs the state's system of 34 public community and technical colleges
CoP: Council of Presidents	Fosters coordination and collaboration between Washington's six public baccalaureate institutions and serves as their common voice
WSAC: Washington Student Achievement Council	Leads statewide strategic planning to improve education coordination and transitions in support of higher levels of education attainment

*OSPI: Office of Superintendent of Public Instruction, State of Washington. "About the Agency." Retrieved from https://www.k12.wa.us/about-ospi/about-agency

State of Washington Education Policy Snapshot

Mathematics credits required for high school graduation	3 credits
Algebra II requirement	Not mandatory; students choose a third credit mathematics course based on education and career goals expressed in a High School and Beyond Plan. One option is the Applied Algebra II CTE (Career and Technical Education) course, which is considered equivalent to Algebra II.
Admission to credit-bearing courses in community and technical colleges	Multiple ways to qualify, including a B or higher in the Bridge to College Mathematics transition course.
Admission to public baccalaureate institutions	The minimum admissions standards, called the Core Academic Distribution Requirements, or CADRs, specify three years of high school mathematics, including Algebra II, as well as a mathematics-based quantitative course in the senior year of high school. The latter requirement can be met by Algebra II, advanced mathematics courses such as precalculus or calculus, algebra-based science courses such as Chemistry and Physics, Advanced Placement Computer Science, or Statistics.
College placement	Community and technical colleges use a common cut-off on the Smarter Balanced assessment and accept a B- or better in the state's transition course to designate college readiness. The baccalaureate institutions set their own placement criteria. The University of Washington administers its own mathematics placement test. Students who have previously taken college mathematics courses or who have qualifying AP/ International Baccalaureate (IB) credits may be exempt.
Other relevant policies	House Bill 1599 (2019) provides several assessment and credit-based options for graduation pathways, such as achieving certain scores on Smarter Balanced, Advanced Placement, International Baccalaureate, SAT, ACT, or ASVAB (Armed Services Vocational Aptitude Battery) exams; qualifying for college credit in dual-credit courses; earning credit in a high school transition course, or earning credit in career and technical education courses relevant to a student's postsecondary pathway. These options may also meet certain postsecondary institutions' admissions requirements.

Washington Student Numbers



*34.0% in 4-year institutions and 28.0% in 2-year institutions

Sources for student data

[A] 2018–2019. Report Card Enrollment 2018–19 School Year. State of Washington. https://data.wa.gov/Education/Report-Card-Enrollment-2018-19-School-Year/u4gd-6wxx

[B] Provided by the Washington Office of Superintendent of Public Instruction

[C] High school graduating class of 2019. Graduation rate is based on a cohort of students. The cohort is made up of all students who start ninth grade together. Students who transfer into or out of a school are added or removed from the cohort.

This and the next citation are sourced from the Washington Office of Superintendent of Public Instruction, Washington State Report Card. https://washingtonstatereportcard.ospi.k12.wa.us/ReportCard

[D] High school graduating class of 2019. Washington Office of Superintendent of Public Instruction, Washington State Report Card. https://washingtonstatereportcard.ospi.k12.wa.us/ReportCard/ViewSchoolOrDistrict/103300

[E] High school graduating class of 2016. 34.0% enrolled in four-year institutions and 28.0% enrolled in two-year institutions. Education Data and Research Center. (2019 January). High School Graduate Outcomes. https://erdc.wa.gov/data-dashboards/high-school-graduate-outcomes

Launch Years initiative

Backmatter

Endnotes for Why Launch Years? Why Now?

[1] See, for example, page 5 in Phil Daro & Harold Asturias. (2019 October). *Branching Out: Designing High School Math Pathways for Equity.* Berkeley, CA: Just Equations. Available at
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What Do We Need To Change? (Recommendations 1–4)

Recommendation 1: Secondary and postsecondary institutions offer multiple effective and aligned mathematics pathways.

Strategy 1a: State agencies, postsecondary education systems, and institutions modernize mathematics pathways.

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Strategy 1b: Secondary education systems collaborate with postsecondary partners to offer aligned mathematics pathways.

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Strategy 1c: Secondary and postsecondary education systems adopt or develop mathematics course design frameworks that define expectations for quality.

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Recommendation 2: Postsecondary institutions and other providers prepare preservice and in-service teachers to teach multiple mathematics pathways.

Strategy 2a: Preservice programs incorporate emerging effective practices in mathematics pathways.

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Strategy 2b: In-service teachers and faculty receive ongoing support to implement, improve, and sustain mathematics pathways.

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Strategy 2c: Secondary, postsecondary, and business and industry sectors collaborate to create innovative solutions to teacher shortages.

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Recommendation 3: Education institutions offer robust supports to help students navigate mathematics pathways, maximize learning, and access broader postsecondary options.

Strategy 3a: Students receive high-quality support to promote learning and academic success in mathematics.

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Strategy 3b: Students receive comprehensive advising to help guide them to the appropriate mathematics pathway that aligns with their postsecondary interests.

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Strategy 3c: Institutions provide supports to help students explore career options, set goals, and understand how to access postsecondary options.

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Recommendation 4: Business and industry partners actively inform the design of education opportunities that support students' goals.

Strategy 4a: Secondary and postsecondary education systems leverage cross-sector partnerships to inform mathematics pathways with data from labor markets.

Strategy 4b: Business, industry and the education sectors increase work-based learning opportunities—and provide supporting materials—for educators and students.

Strategy 4c: Researchers and leaders regularly collect and use data to refine measures of "relevant mathematics."

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How Do We Bring Change to Scale? (Recommendations 5–6)

Recommendation 5: State agencies and education systems develop policies that enable smooth student transitions from secondary to postsecondary mathematics.

Strategy 5a: State promote advanced mathematics course-taking.

Strategy 5b: State agencies and education systems create policies that support cross-sector alignment of mathematics pathways.

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Strategy 5c: State agencies and education systems implement policies that support a coherent system for demonstrating postsecondary readiness.

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Strategy 5d: Postsecondary leaders ensure their admissions policies place equal value on all mathematics pathways.

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Recommendation 6: State agencies and education systems, institutions, and schools build a strong shared understanding of—and commitment to—goals among their constituents.

Strategy 6a: Leaders establish a common language for communicating about efforts to improve the transition from secondary to postsecondary mathematics.

Strategy 6b: Leaders use communications and engagement strategies to inspire and mobilize diverse constituents.

Strategy 6c: Leaders ensure that communications equitably inform and engage diverse populations.

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How Will We Measure Impact and Improve? (Recommendation 7)

Recommendation 7: State agencies, systems, and institutions use data and research to measure impact and to inform continuous improvement of mathematics pathways.

Strategy 7a: State agencies and systems establish and use shared success metrics.

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Strategy 7c: States use their data systems to track student progress across sectors.

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About the Dana Center

The Charles A. Dana Center develops and scales mathematics and science education innovations to support educators, administrators, and policymakers in creating seamless transitions throughout the K–16 system for all students, especially those who have historically been underserved. We focus in particular on strategies for improving student engagement, motivation, persistence, and achievement.

The Center was founded in 1991 at The University of Texas at Austin. Our staff members have expertise in leadership, literacy, research, program evaluation, mathematics and science education, policy and systemic reform, and services to high-need populations.

About Launch Years

Launch Years is an initiative led by the Charles A. Dana Center at The University of Texas at Austin—in collaboration with Community College Research Center, Achieve, Education Strategy Group, and the Association of Public and Land-grant Universities—focused on addressing systemic barriers that prevent students from succeeding in mathematics and progressing to postsecondary and career success. Leveraging work within states, the initiative seeks to modernize math in high school through relevant and rigorous math courses as well as policies and practices leading to more equitable outcomes for all students. **Learn more at: utdanacenter.org/launch-years.**

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