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## Corequisite Mathematics Toolkit

# Practice Profiles

These concrete examples of mid-level leadership in practice highlight colleges doing exceptional work and field-based lessons. They document ways in which institutions have customized corequisite programs to suit their unique context and best serve their student populations.

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**Supported by:** Strong Start to Finish and Education Commission of the States



Every student deserves a strong start in their first year of college. This toolkit is part of a SSTF three-part series, providing resources to assist postsecondary leaders design and implement reform strategies that support equitable outcomes for students who are marginalized and racially minoritized.



The University of Texas at Austin  
Charles A. Dana Center



# Austin Community College

An “express” model that blends college-level and pre-college material

## A two-pronged approach

Corequisites are nothing new at the Austin Community College (ACC) system, so there’s a lot to learn from their experiences. The ACC mathematics faculty launched its first pilots in 2017, the same year the Texas state legislature passed a bill requiring all public institutions to scale corequisite approaches.

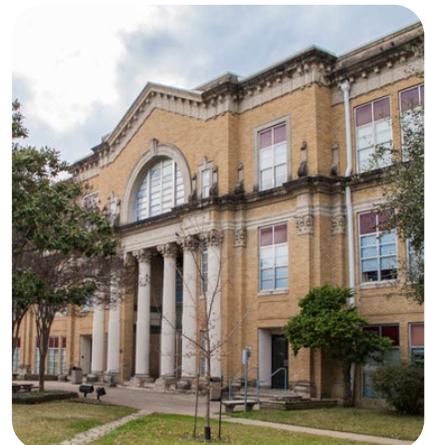
The ACC mathematics faculty were not caught unprepared by these legislative mandates.

Unlike most other colleges in the United States, ACC offers two levels of corequisites for three of its five gateway math courses: College Algebra, Contemporary Mathematics and Elementary Statistics.

At the time of this writing, readiness for college-level mathematics in Texas is typically determined by the state exam. For students assessed as needing more support (e.g., those who might have taken two semesters of developmental math in the past), ACC implemented “Express” courses that cover pre-college through college-level topics.

Students who are nearly ready for college-level courses have a different option. For College Algebra, such students are enrolled directly in the college course with a concurrent two-hour support course. For Contemporary Math and Elementary Statistics, students who are just below the placement cut score for college readiness are enrolled in a seamless four-hour course where the aligned support content is added where needed.

- Located in Central Texas
- 11 campuses
- 75,000+ students enrolled; 41,000 in credit courses
- Students in credit courses are 42% white, 38% Latinx, 8% Black, 6% Asian/Pacific Islander, 6% other, 4% two or more



## Strategies for success

Developmental content offered by ACC math instructors is not distinct from the college-level content. The curricula for these courses are back mapped from the college-level content and fully integrated or “spiraled.” These six- or seven-hour courses feature two instructors who simultaneously team teach and who use active learning strategies, facilitating for the majority of class time rather than lecturing. Each teacher has a specific set of responsibilities: One oversees the support portion of the course, and the other ensures that the students learn the college material.

Student progression data was crucial to gaining support from the college’s advisors — the people who help students choose and enroll in courses. Course completion data was already commonly shared, but the administration made changes to allow departments to easily access longitudinal student data. Campus math contacts were appointed to meet regularly with advisors and share data showing how students were performing in the corequisite courses compared to traditional developmental sequences. The math department also developed an FAQ list designed specifically for the advising staff.

Support from the college administration played an important role. For example, resources were provided for visits from faculty from other Texas colleges who were having some success with corequisites. Release time was given to ACC faculty to examine the math curriculum in detail and to redesign the developmental sequences.

Another key tactic was closely monitoring student outcomes. When the data showed corequisites were enabling students to earn college math credit more quickly, ACC scaled up these courses. By spring 2019, 70 percent of developmental math students were enrolled in corequisites, which increased to over 75 percent in fall 2019.

## Results show five-fold increase in completion rates

ACC’s corequisite models have led to clear and consistent results. One example: The success rate for Algebra Express is about five times the rate for completion of the traditional two-course developmental sequence followed by College Algebra.

Before corequisite implementation, students who were referred to developmental math could not access college courses. Just under one-quarter of all first-time-in-college (FTIC) students

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*“We went full-scale faster than we thought for certain courses because the differences in outcomes were so dramatic. Why would we not go full-scale?”*

—CAROLYNN REED, ACC MATH DEPARTMENT CHAIR

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— including those who were not referred to remediation — were able to enroll in a college-level math course during the 2014–15 academic year. By 2018–19, nearly 40 percent of FTIC students had accessed a college-level math course. These gains were even more significant among Latinx and Black/African American students.

### Meet Kimberly

Kimberly, an Austin college student, had two previous failures in college mathematics before attempting the corequisite format. Communicating to an advisor that she didn't feel comfortable in mathematics and needed more help, she was recommended for Contemporary Mathematics Express.

Kimberly described the course as a "mixture of all math, in a way. They didn't do one math, they did a little bit of statistics, this and that, it was real-world problems, probability. They put a lot of different kinds of math in there, and it was helpful, not just one kind of math. Things I wish I was taught in high school, earlier in life. They filled in some gaps." She also said, "I second-guess myself a lot, and the professor said I have to stop doing that. They helped me with understanding the steps and then doing it on my own." Kimberly, who said, "I'm not good at math," completed the course with an A.

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# Diablo Valley College

## A direct path to college credit, with integrated supports

*Diablo Valley College offers corequisites with developmental content carefully interwoven into a single course.*

### Starting with a new approach to placement

In 2017, the California state legislature passed a bill requiring colleges to maximize the probability that all students can enroll in and complete transfer-level math and English in a single year. Although Diablo Valley College (DVC) did not offer corequisites at the time, it had paved the way for their implementation by adopting multiple measures placement, investing in faculty professional development and using Statway, a two-term statistics course that provides additional mathematics support for students who need it.

DVC launched corequisite math courses during the 2019-20 school year for each of the entry courses in its math pathways: college algebra, trigonometry and statistics. Despite the COVID-19 pandemic disrupting in-person learning that spring, students who enrolled in these corequisite courses showed strong success

### Integrated counseling helps students engage

DVC adopted a model in which a multiple measures placement tool requires students with lower GPAs to enroll in a section of the college-level math class with an integrated corequisite supports course. These students join others in corequisite-supported transfer-level math courses that enable them to build skills, confidence and community with their peers and the instructor.

Most instructors do not separate out the corequisite supports. In these classes, students who are enrolled in a college-level course along with a support course experience the class as a single integrated course taught by a single instructor, with developmental content carefully

- Located in Northern California (San Francisco Bay area)
- 18,000 students enrolled from 10 municipalities
- Launched corequisite math courses in 2019
- Of those who enrolled in corequisite courses, 67 percent earned college-level credit in a single term



interwoven throughout. This approach “reduces student resistance to the support aspects of the course and helps ensure that students engage in both the support and college-level content throughout the entire course,” according to math professor Read Vanderbilt.

Individual support goes beyond the classroom. Roughly two-thirds of all math faculty teaching courses with corequisites have chosen to integrate counseling and tutoring support into their classes. Counselors and tutors connect with the instructor to discuss the needs of the class and meet individually with the students to provide guidance or recommend student services.

DVC established credit and contact hours to account for the additional time needed to cover the combined college-level and support materials. The four-credit statistics and three-credit trigonometry courses taught with corequisites are each augmented with a one-unit developmental support course (two hours, 15 minutes contact hours per week and about one hour of out-of-class study). The four-credit college algebra course taught with a corequisite is augmented with a two-unit developmental course (four hours, 30 minutes contact hours per week and two hours, 15 minutes out of class study).

### **Most students earn college-level credit in a single term**

Less than two years in, the new corequisite program shows very promising outcomes. Prior to the reform efforts, just 12 percent of DVC students who placed into developmental math completed their gateway course in one year and only 20 percent completed it within two years. When corequisites were introduced in fall 2019, enrollment in prerequisite developmental mathematics was reduced by 78 percent. Of those who enrolled in corequisite courses, 67 percent earned college-level credit in a single term.

When corequisites were introduced in fall 2019, enrollment in prerequisite developmental mathematics was reduced by 78 percent. Of those who enrolled in corequisite courses, 67 percent earned college-level credit in a single term.

DVC continues to offer a six-credit, two-term stretch sequence for students requiring additional support. The results are impressive, with 82 percent of these students earning college-level credit in a single year. Instructors believe this approach is particularly well suited for students with high levels of math anxiety or with learning disabilities, given the additional time devoted to the concepts and the unique instructional design.

Even more impressive is that students in the corequisite courses performed comparably to students who were taking the same college-level courses without the corequisite supports.

“Because the students placed in coreqs have the lowest placements, one might expect their course results to be much lower. But so far, their results have been consistent with or just slightly lower than outcomes of students in the college standalone courses,” said Despina Prapavessi, the mathematics dean.

As the college continues the corequisite implementation, it aims to further reduce enrollment in developmental courses, address equity gaps, and increase the success rate of corequisite courses.

# Roane State Community College

## Removing the roadblocks to a degree

*Roane State Community College uses corequisites to build crucial momentum toward students' intended area of study.*

### Helping students get un-“stuck”

For many years, Roane State required some students to take up to three semesters of developmental math. Following a state requirement, the college previously offered emporium-style labs for developmental math — a self-paced, modularized model that lacks a traditional instructional model. Students could theoretically complete all of their developmental math in one semester and quickly move on to take their general education college-level course.

But there was a problem. Few students actually progressed. According to the college, only 20 percent of students requiring developmental education completed their prerequisite modularized math and a college-level statistics course within one academic year (including the summer term). “We especially heard from faculty in areas like allied health that students continued to be ‘stuck’ and couldn’t reach their program courses,” said Elizabeth Weaver, a math professor at the college.

Roane State’s challenges were not unique. In 2014, recognizing that modularized math did not ultimately help students succeed, the Tennessee Board of Regents mandated the elimination of prerequisite math developmental education in the state’s community colleges by fall 2015. The state moved to a corequisite model and developed policy guidelines for corequisite courses. Roane State received a \$13,500 grant to support instructors in designing them.

### Pacing and coordination are key

Roane State designed its approach to corequisites with the goal of helping students find early success in college math and gaining critical momentum toward their degree.

- Eastern Tennessee
- Nine campuses across eight counties
- 5,000 students
- Primarily rural and suburban
- 60 percent Pell recipients (First time in college)
- Started offering corequisites in 2015-16
- The number of Pell-eligible students who passed a math course increased by 69 percent in the first few years after implementation



The statistics gateway course and its corequisite each meet twice per week for 80 minutes and both carry three credit hours. Due to scheduling challenges, students have different professors for their corequisite and statistics courses, and corequisite students in the same gateway course do not all enroll together in the same corequisite course.

Because students do not stay together, the college carefully designs the corequisite learning support class so that its pacing consistently syncs with and complements the content that students are learning in their college-level statistics course. The goal is that students will see the value and connections between the two, rather than feeling as though they're taking two separate math courses.

This approach means working diligently and frequently across the math department to create detailed curricula and pacing guides. The guides ensure that instructors are reinforcing statistics content taught in the gateway course at the right time and are using consistent pedagogical activities. There is a lead faculty member at Roane State whose role is to communicate with full-time faculty and adjunct faculty across the college, coordinate curricular revisions and organize professional development activities that keep faculty and other staff up to date.

The corequisite course does not use a textbook. Instead, it presents structured activities to support the learning objectives in the statistics course as well as meet some of the corequisite's own learning objectives. For example, the college recently revised its corequisite course to embed more targeted algebraic concepts. This change ensures that, in addition to succeeding in statistics, students are prepared to succeed in program courses, such as chemistry, that they may take in the future.

### Less math fatigue

Faculty at Roane State report that having more students attain college math credit at the beginning of their college experience has been a real benefit. "It's a huge change, and students are so grateful," said Weaver. "We also see less math fatigue because students are moving more quickly into their programs of study."

The data enforce those sentiments. Fifty-four percent more students completed college-level math within a year in 2018–19 compared to 2014–15, the last year before corequisites were implemented. Within two years, there was a 34-percent rise. Among Pell-eligible students, the increase was even greater: 69 percent within one year and 43 percent within two years.

While all of these numbers represent significant gains, the positive outcomes are particularly noteworthy for students from low-income families.

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*Within two years of corequisites being implemented, there was a 34-percent rise in students who completed college-level math within a year. Among Pell-eligible students, the increase was even greater: 69 percent within one year and 43 percent within two years.*

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# University of Wisconsin

## Regular contact keeps math students on track

*How corequisites helped one institution narrow racial disparities and retain more students.*

### When math course sequences leave students behind

The University of Wisconsin-Milwaukee (UWM) took the first steps toward reforming its mathematics program back in 2014, when it adopted an active instructional model and implemented math pathways for both a STEM-focused algebra path and a quantitative reasoning math literacy path called Quantway.

Success rates for gateway courses rose dramatically, but deeper analysis revealed a problem. The math department was losing roughly 20 percent of its students between the developmental-level first term and the college-level second term.

Enter corequisites. By fall 2020, UWM had replaced nearly all of its developmental math courses with single-term corequisite courses, enabling all but STEM majors testing two levels below college algebra to enroll directly in college-level math. UWM continues to improve on these courses and is currently testing whether the Quantway corequisite plus a one-credit algebraic skills course can prepare these lowest-placing STEM majors for college algebra.

The results are striking, particularly when it comes to narrowing disparities between Black and white students. Prior to the implementation of corequisites, the success-rate gap between these two groups was 20 percentage points for college algebra and 32 percentage points for quantitative reasoning. After the introduction of corequisites, those gaps have narrowed to 12 percentage points and 5 percentage points, respectively.<sup>7</sup>

7. Data are from fall 2017 through spring 2020. The quantitative reasoning corequisite began spring 2018, and the college algebra corequisite began fall 2018.

- Main campus + two branch campuses
- 25,000 students enrolled
- Forty percent of first-year students need mathematics support
- 81 percent average corequisite success rate



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*After the implementation of corequisites, the gaps between Black and white students for college algebra narrowed to 12 percentage points, from a baseline of 20 percentage points.*

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### Supportive by design

An important element of UWM's design is the course structure. The Quantway corequisite course meets four days per week, 75 minutes for each session. It alternates days for the support content and the college-level content, ensuring equivalent time spent on each. Students earn three developmental math credits and three college-level credits upon completion.

While a six-credit course demands sacrifice on the part of students, the time investment has significant benefits. Meeting four days per week allows students to practice math almost every day and have regular access to their instructor and peers, resulting in less chance of falling behind.

Instructor Kelly Kohlmetz described how this structure impacts her teaching approach as well: "I get to know my students better, so I know when they're struggling. Because I'm seeing them four days a week, I can see sooner when they're having an issue."

Social-emotional supports are built into the corequisite curriculum for both quantitative reasoning and algebra. These supports, collectively known as Productive Persistence, help students build confidence and strategies to persist through challenging content, while also fostering an inclusive community where students feel they can make mistakes and grow as learners. Key routines and activities nurture positive mindsets, productive study skills and a sense of belonging for each student in the class.

Another strategy is making the curricula distinctly relevant and of interest to students. For example, the Quantway curriculum presents math literacy content and concepts using themes that are relevant to non-STEM students — citizenship, personal finance, medical literacy and social justice. Similarly, the algebra corequisite content is designed to serve the needs and interests of STEM students.

UWM leadership has supported instructors throughout the transition to corequisites. Since 2017, the UW system has provided grant funding to support instructors in the planning, design and development of the corequisite courses. The math department provides ongoing support for professional learning and the continuous improvement of the courses and the student learning experience. UWM instructors also engage in periodic class visits and hold weekly meetings to learn from one another about what is working so that they can continuously improve their approach.

### Single-term success

By taking two career-aligned pathways focused on active learning with structured social-emotional learning supports, and redesigning them as corequisites, UWM is helping more students than ever succeed in earning their transfer-level math credit in a single term.

UWM's average corequisite success rate is 81 percent, demonstrating that substantially more students are achieving transfer-level math credit in less than a year and advancing toward their goals.

Between spring 2018 and spring 2020, UWM enrolled 373 students in its quantitative corequisite course with an average success rate of 86 percent. This is a 13 percent improvement from the previous two-term quantitative reasoning sequence and a 30 percent increase compared to the university's original approach to remediation.

UWM's algebra corequisite has served 528 students since fall 2018 and has achieved an average success rate of 77 percent, a 22 percent gain compared to the original developmental approach. While not significantly higher than the previous pathway sequence outcomes, the algebra corequisite is preventing the student attrition that took place between terms and enabling students to achieve college credit in just a single term.

### Meet William

When William enrolled in UWM's quantitative reasoning with corequisite supports in spring 2020, he knew he was taking a leap. "When the word math comes up, I'm terrified. I've been fearful of math since I was a kid."

A 58-year-old veteran, William was returning to school to get his B.A. in social work to help him advance toward a career in Veterans Affairs. He received his GED while in the military, which was the last time that he encountered anything related to a math course. While pursuing his AA, he had kept math on the back burner, but to complete his degree at UWM, he could not afford to ignore it any longer.

When UWM's placement policies suggested that William could benefit from additional math support, he was encouraged by his UWM advisor to consider quantitative reasoning with a corequisite. The credit load seemed daunting, but the opportunity to enroll in a math course that would count toward his degree was the deciding factor.

William was unsure whether he'd be successful in the course, but ultimately he not only passed, but he also earned an "A." He attributes his success in part to the high contact hours. Regularly meeting in class or online with his group mates and the instructor helped him form bonds with his peers and kept him engaged throughout the course. "[The schedule] actually worked out to my benefit. I go to school full-time and work part-time at night. I needed to have such a schedule to stay on track." In addition to the schedule, he found the corequisite supports to be very helpful in preparing him for the college-level lessons on the alternating days. He also credits the availability and encouragement of his instructor in helping him persevere, especially as the course shifted online due to the COVID-19 pandemic.

Considering his previous experience with math, this outcome was quite profound. "My final grade was an A in math," William recalled. "For me to end up with such a great grade, to do well on the exam and to be comfortable doing the exam ... was extremely helpful to me." Beyond the course grade, another important outcome for William is his sense of confidence in his math skills — skills that he now finds himself sharing with the kids at the youth home where he currently works. William, having avoided a long cycle of remedial coursework, completed his college math requirement in a single term and is on track to graduate in May 2021, as planned.

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# Northwest Missouri State University

## Partnering with faculty in other disciplines to better serve students

*Northwest Missouri State University created new math pathways with corequisites based on feedback from instructors in other subject areas.*

### Pivoting from emporium model to corequisites

Like other institutions, Northwest Missouri State University was already in the process of reforming its mathematics program prior to the implementation of corequisites. This began in 2014, when the university moved from traditional developmental courses to emporium-style delivery using computer-based instruction. Unfortunately, students continued to struggle. “We knew there had to be a better way. We were failing our students,” said Csilla Tasi, a math professor at the university.

A couple years later, administrative and faculty leaders switched gears. They decided to implement a math pathways effort along with corequisites, at scale, across all of the university’s math gateway courses. “As a department, we had started to see corequisite data from other places, and it was a no-brainer to move away from what we were doing—it wasn’t working,” said Christine Benson, then-chair of the math department. Full implementation of the new pathways and corequisites began in fall 2016.

Today, all students at Northwest Missouri have access to college-level math. In 2014, before corequisites were implemented across the institution, just 42 percent of students had access. In fall 2014, only nine students who took a developmental math course earned college credit. By fall 2019 — after corequisite implementation — that number had risen to 57, a dramatic increase.

- 7,000 students
- Rural and mostly white
- Roughly half first-generation college students
- Fifty-seven students who enrolled in corequisite math earned college credit in fall 2019, compared to only nine the fall before corequisites were introduced



### Gathering input from other departments

Math faculty at Northwest Missouri began their efforts to align math with majors by reaching out to faculty in other

disciplines, first through a survey asking program faculty to identify the specific math competencies their students need. The survey broke down math competencies by subject areas — rather than by courses — in order to move away from default mindsets and expectations about what courses students need. Faculty in the math department analyzed survey results and shared initial recommendations with program faculty about the right math classes for their students.

“We learned that faculty in other program areas didn’t think their students were taking the wrong math, but they were aware that students were often leaving their major, or the campus, because of math-related barriers,” said Brian Haile, math department chair. Following the survey, math faculty held multiple discussions with program departments to inform their math pathway decisions.

This campus wide work led to the creation of four math pathways, resulting in far fewer students taking College Algebra as their starting point. For example, business and agriculture students enroll in Statistics as their first math course, and business students subsequently take a second mathematics course, Mathematical Modeling, which is a newly developed course to provide the specific algebraic and modeling content they need.

### **Corequisites focus on forming new mindsets around math**

The university no longer offers prerequisite developmental math courses. If required, students enroll in a corequisite “strategies” section that accompanies the entry-level college course for their math pathway. The university calls the corequisites “strategy classes” because they include instruction on making better habits and forming new mindsets around math — not just learning math content. More specifically, the corequisites include structured activities that teach time management, study skills and critical thinking.

For most entry-level courses, administrators consider both GPA and test scores for determining whether students will take a corequisite. Using GPA as a placement tool aligns with evidence that using multiple measures, such as a student’s high school GPA that combines many variables, leads to more students earning more college-level credits more quickly compared to using test scores alone.

Students who are required to take a corequisite are in the same college-level course sections as those who do not require the additional support. Corequisite sections meet for two hours per week; they do not carry credit that counts toward graduation requirements. All math faculty rotate to teach a corequisite section, as the department believes faculty should be familiar with the needs of under-prepared students. Departmental planning ensures corequisites keep pace with topics taught in the college-level courses.

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# About This Toolkit

The development of this toolkit was guided by the advice of a national advisory panel made up of experts who have worked deeply with corequisites across a variety of roles and contexts. The panel includes researchers, policymakers, faculty members, equity advocates and curriculum experts who collectively articulated a consensus statement on the foundational core of this toolkit, the “Corequisite Design Principles” document and vetted the associated resources.

## About The Authors

### Project Lead

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Connie leads the curriculum development team for the Dana Center Mathematics Pathways, a transformative redesign to modernize entry-level college mathematics programs through working with states, systems, universities and colleges. She also supports the development of DCMP’s professional learning offerings related to curricular redesign, corequisite supports and pedagogy. In this work, Connie collaborates with faculty to identify best practices and disseminate to the field.

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### **About The Charles A. Dana Center**

The Dana Center works to dismantle barriers in education systems to ensure all students—especially those who have historically been underserved—have equitable access to and success in an excellent math and science education. Our higher education work focuses on strategies and tools that support faculty and institutions in creating more seamless transitions from high school to and through gateway mathematics courses.

### **About Strong Start to Finish**

Strong Start to Finish is a network of policy and research partners, institution and systems leaders, and foundations advancing system reforms in developmental education, so every student can succeed in their first year of college. In particular, we support college success for Black, Brown, Asian American, Indigenous students, adult learners, and students with low incomes, who have been underserved by the education system for too long. We work to scale the use of proven, proactive strategies that remove barriers that typically impede these students from earning essential college credits in English and Math courses in their first year. Education Commission of the States is the host of the Strong Start to Finish network.



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