

**LEE COLLEGE AND DEVELOPMENTAL
MATH EDUCATION:**

LEADING A SYSTEMATIC CHANGE PROCESS

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ACKNOWLEDGEMENTS

We would like to thank the Developmental Education Division and Mathematics faculty at Lee College, who designed, implemented and revised the developmental education and mathematics pathways. The continuous commitment by these individuals to serve students enables systematic change to occur. We would also like to thank Lee College's leadership team for providing us the opportunity to collaborate with their institution in order to understand how they enacted these changes over time. A special thanks goes out to Dr. Victoria Marron, Roshele Friudenberg and Dr. Douglas Walcerz for their expertise and support throughout the project. Finally, we would also like to thank Strong Start to Finish for its dedication to highlighting the work that Hispanic-serving institutions do, and its guidance throughout the article revision process.



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Executive Summary

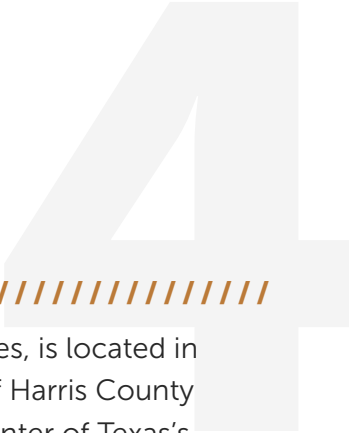
Today's community colleges are challenged to reform developmental mathematics education and improve mathematics pathways. Almost 60% of incoming college students at two-year institutions are placed into at least one developmental mathematics course (Chen, 2016). Only 33% of students who place into developmental mathematics will successfully complete the developmental course sequence, and only 20% of these students will complete a college-level mathematics course (Bailey et al., 2009; Rutschow, 2019). Hispanic-Serving Institutions (HSIs) must balance a series of competing demands, both at the local and state levels, as they enact change. However, little is known about how faculty, staff and administrators at these institutions engage with the change process to reform developmental mathematics.

The change process for Lee College, an HSI in Texas, began with a vision for change and recognition of structural barriers. Stakeholders at Lee envisioned that every student persists to degree completion, enrolls into credit-bearing courses as quickly as possible and that experiences within these courses lay a solid foundation for learning in an appropriate math pathway. This shared vision is in response to the barriers that students faced at Lee College. In the years preceding the initiation of the change process, too many students did not complete developmental math, nor enroll and persist within a credit-bearing math course. In addition, math pathways, including those at the developmental education level, were challenging and difficult to navigate, leading to low course success rates in multiple credit mathematics courses across all student demographics.

To combat these challenges, stakeholders at Lee chose to accelerate course completion and redesign classrooms to increase student engagement. The developmental math department also focused on implementing clear mathematics pathways with corequisite courses.

The outcomes of Lee's change efforts resulted in an overall increase in students' successful completion of credit-bearing mathematics courses under the corequisite model. During and after the change process, administrators, faculty and staff strengthened their understanding of student needs, grew their ability to balance student and stakeholder needs and moved toward embracing their identity as an HSI. Going forward, Lee College is looking to support corequisite implementation by enhancing student advising practices, implementing mobile phone app technology and establishing formal equity-promoting structures.

Background & Context



LOCATION & STUDENT POPULATION //

Lee College, a two-year college offering associate degrees and certificates, is located in Baytown, Texas. Baytown is in the Houston metropolitan area as a part of Harris County within the Gulf Coast region of the United States. Lee College is in the center of Texas’s petrochemical industry (Lee College, 2020), with Exxon Mobil and Chevron, two of the largest petrochemical corporations, located within Baytown, Texas. The city, with a population of 77,000+ residents, has a significant Hispanic/Latinx population. According to 2019 census data, people from Hispanic/Latinx backgrounds comprised 47% of the Baytown populace, making it the largest ethnic group in Baytown (U.S. Census Bureau, 2019).

Lee College annually serves more than 8,000 students through more than 100 associate degree and certificate programs, as well as non-credit workforce and community education courses. Approximately 60% of students are from underrepresented racial/ethnic backgrounds (Hispanic/Latinx: 38%, Black: 17%, Other: 5%) and many are the first in their family to attend college. The mission of Lee College is to “serve the community by providing innovative and quality education to our diverse students along guided pathways to gainful employment, personal enrichment and life-long learning.” Nationally recognized as one of the top 150 colleges in the United States by the Aspen Institute for five consecutive years, Lee College has received many prestigious awards, including the 2015 American Association of Community Colleges Award of Excellence for Student Success, the 2018 American Association of Community Colleges Award of Excellence for Advancing Diversity and the 2018 Association of Community College Trustees Regional Equity Award and National Finalist.

POLICY FACTORS //

Legislation from the State of Texas, including House Bill 2223 has had the most direct impact on developmental math education policies at Lee College. HB 2223, signed into law in 2017, requires that a certain percentage of students in developmental education be enrolled in a corequisite model. This enables students to simultaneously co-enroll in an entry-level college course for credit and a developmental course/intervention that supports successful completion of the college-level course.

The bill mandates that by fall 2020, 75% of students enrolled in developmental education must be enrolled in a corequisite model. For developmental math, this means that a portion

of the enrolled students must be simultaneously enrolled in both a developmental math course and a credit-bearing math course such as college algebra or statistics. This state policy accelerated departmental and institutional conversations, and actions, on developmental math education reform.

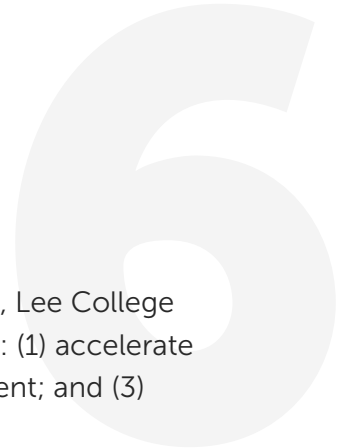
SOURCES OF SUPPORT //

Lee College is supported by various technical and grant initiatives at both the state and national levels. The Charles A. Dana Center at the University of Texas at Austin provides Dana Center Mathematics Pathways technical assistance to higher education partners. The Dana Center uses evidence-based curriculum and pedagogy to encourage mathematics pathways that are aligned to students' goals, accelerate completion, and integrate learning supports. DCMP's technical assistance includes professional learning opportunities and toolkits for faculty, staff and leaders; customized institutional- and state-level consulting options; and a variety of resources for implementation.

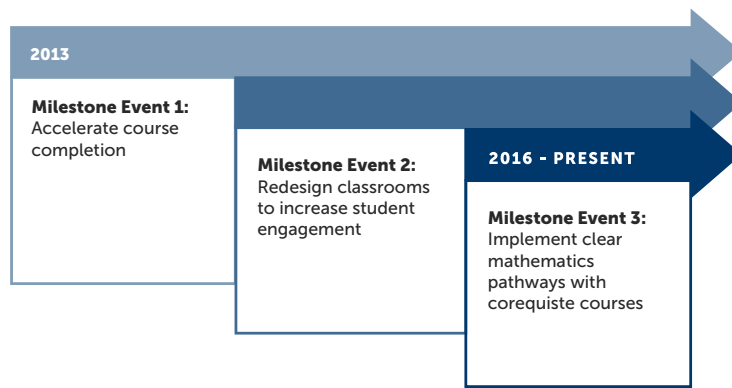
The institution has also benefited from a series of federal and state grants focused on HSIs and STEM.

- In 2011, the U.S. Department of Education awarded Lee College the HSI STEM and Articulation Programs Grant, which enhanced STEM course offerings, implemented additional student support services and created more robust articulation agreements with four-year institutions. This grant also created the first STEM Center and provided foundational support for the Learning Hub, which offers free math/science tutoring, computer access and individual/group study spaces.
- In 2016, Educate Texas awarded the college the Regional STEM Degree Accelerator grant to increase the number of underrepresented students with STEM credentials entering the petrochemical workforce and provide professional development and technical data support for Lee College to lead a regional consortium of K-12, higher education and workforce partners.
- In 2016 and 2019, the college was also granted a U.S. Department of Education Developing HSIs Grants (Title V) award to strengthen pathways to three-year completion, especially for first-generation Latinx college students and part-time college students through enhancing wraparound support services and first-year experiences.

The Change Process



To create a supportive educational ecosystem for student success in math, Lee College engaged in a four-pronged approach to reforming mathematics pathways: (1) accelerate course completion; (2) redesign classrooms to increase student engagement; and (3) implement clear mathematics pathways with corequisite courses.



MILESTONE EVENT 1: ACCELERATE COURSE COMPLETION //

In 2013, when Lee College undertook efforts to increase the number of students transitioning from developmental math courses to math courses for credit, all developmental courses were 16 weeks long and students were required to complete them in sequence. Depending on how students scored on their placement exam, they were required to take up to three developmental courses over three semesters before enrolling in a math course for credit. To accelerate course completion, Lee College eliminated the lowest level of developmental math and reduced the three-course sequence to a two-course sequence developmental math pathway. To do so, developmental education faculty examined syllabi and shortened the length of the remaining developmental courses to eight weeks, which enabled students to complete two courses in the same semester. This early effort was successful in decreasing the amount of time required to complete developmental course sequences and in establishing a foundation upon which Lee College continued to build.

MILESTONE EVENT 2: REDESIGN CLASSROOMS TO INCREASE STUDENT ENGAGEMENT //////////////////////////////////////

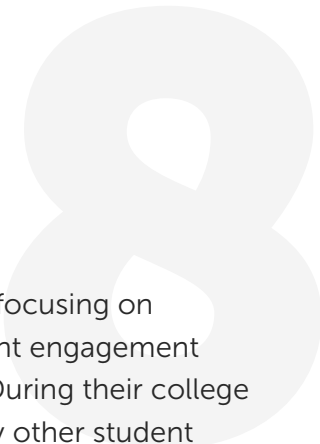
After accelerating course completion, Lee College sought ways to increase student engagement and success in the newly accelerated courses. This resulted in redesigning classrooms to increase student engagement and access to support. A faculty member

introduced the concept of studio learning classrooms and the developmental education department adopted and piloted the concept. Studio learning classrooms remove traditional static seating that is focused on an instructor and replace it with round tables, laptops for each student, televisions for projecting from laptops and whiteboards around the perimeter of the room. The student-centered classroom allowed faculty to create a more active, collaborative and feedback-rich environment for students. Within this model, students had the opportunity to access internet-based mathematics programs, interactive e-textbooks and media learning aids.

Lee College found that the physical changes to the classroom resulted in behavioral changes. Classes were less lecture-based and more group-work oriented and there was an increase in creativity and use of technology by both students and faculty. Faculty saw increased motivation, comprehension and cooperative learning, while students enjoyed the modern and dynamic classroom environment. The positive changes that resulted from physically redesigning classrooms led Lee College to seek [\\$350,000 in funding from the Texas Higher Education Coordinating Board](#) to redesign all of the developmental education classrooms. Lee College is one of 12 institutions in Texas that received this grant, which was designed to support institutional efforts to boost success and completion of underprepared students enrolled in developmental education.

MILESTONE EVENT 3: IMPLEMENT CLEAR MATHEMATICS PATHWAYS WITH COREQUISITE COURSES //

In 2016, prior to the passage of HB 2223, Lee College began implementing clearer mathematics pathways with corequisite courses. Designed to increase student success, everyone agreed that “credit is what matters” and administrators and faculty worked toward a common goal: developing math pathways that allowed students to complete their math sequence in one year. They achieved this in 2019, when all developmental education students, regardless of their starting point, could complete college math within two semesters in their first year at Lee College. This shift is the result of strategic changes that began with a new, non-algebraic mathematics pathway focused on pre-statistics. After the initial acceleration and classroom redesigns described in milestones 1 and 2, every upper-level developmental education math course was converted into a corequisite sequence that placed students in complementary credit and non-credit courses simultaneously. Lee offers these courses in face-to-face, hybrid or online formats. Lee College placed students into one of four credit-bearing math courses based on their degree aspirations: college algebra, finite math, contemporary math or statistics. To ensure quality and consistency, adjunct faculty received a standardized curriculum and lecture notes. Finally, students had access to additional services, including peer mentoring, supplemental instruction and tutoring referrals.



Outcomes

Lee College sought to address student success in developmental math by focusing on accelerating course completion, redesigning classrooms to increase student engagement and implementing clear mathematics pathways with corequisite courses. During their college journey, students who placed into developmental math education (and any other student wishing to review developmental material) had the opportunity to complete corequisite math courses to support their learning and accelerate their progress toward graduation. As this gained momentum, student success in gateway credit-bearing math courses improved at Lee College. The data presented below represent pass rates for gateway credit-bearing courses (college algebra and introductory statistics).

OVERALL CHANGE //

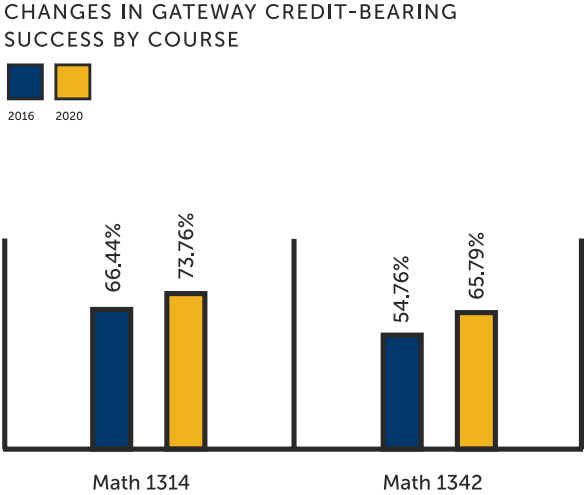
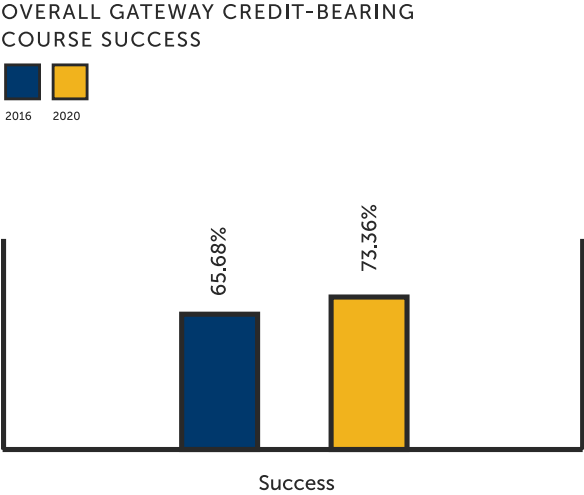


FIGURE 1. Students overall at Lee College showed an increase in gateway course success between 2016 and 2020. In 2016, 65.68% of students passed gateway credit-bearing courses. By 2020, with the full implementation of the corequisite model, that level had risen to 73.36%. Overall, these data suggest that students enrolled in corequisite models experienced greater rates of success following Lee College’s corequisite change efforts starting in 2016.

FIGURE 2. Between 2016-2020, students enrolled in both gateway credit-bearing courses – college algebra (MATH 1314) and introductory statistics (MATH 1342) – showed increases in their success rates. Students in college algebra increased their success by 7.32% and students in introductory statistics increased their success by 11.03%. Overall, these data suggest that students enrolled in both STEM and non-STEM pathways benefited from a corequisite approach.

EQUITY-FOCUSED CHANGE

CHANGES IN GATEWAY CREDIT-BEARING COURSE SUCCESS RATES, FOCUS ON LATINX & BLACK STUDENTS

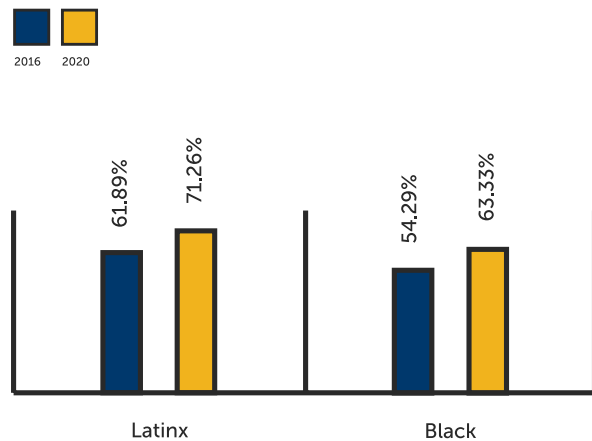


FIGURE 3. Both Latinx and Black students experienced almost 10% increase in their success within gateway credit-bearing courses between 2016 and 2020. The pass rate gains made by Latinx and Black students were particularly important to Lee College given its status as an HSI, with a commitment to meet the needs of Latinx students and other students of historically marginalized backgrounds.

OVERALL GATEWAY CREDIT-BEARING COURSE SUCCESS BY AGE

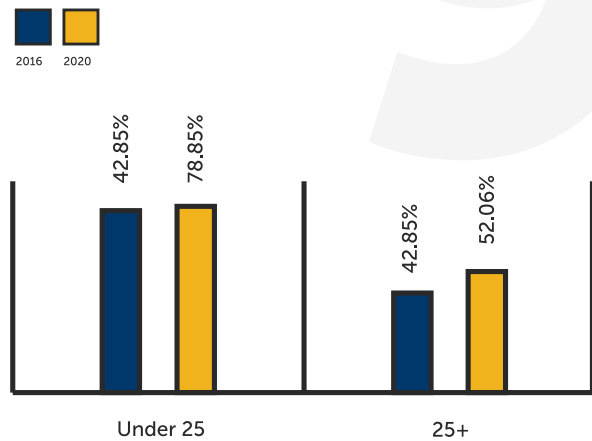


FIGURE 4. Overall, students over 25 experienced positive gains in gateway credit-bearing course success, while students under 25 remained relatively steady. Between 2016 and 2020, students under 25 experienced a small increase in success, moving from 78.60% to 78.85%. Students over 25 experienced an almost 10% increase from 42.85% to 52.06%. Overall, these data suggest that students over 25 may experience even greater benefits from the corequisite model.

CHANGES IN GATEWAY CREDIT-BEARING COURSE SUCCESS RATES BY AGE

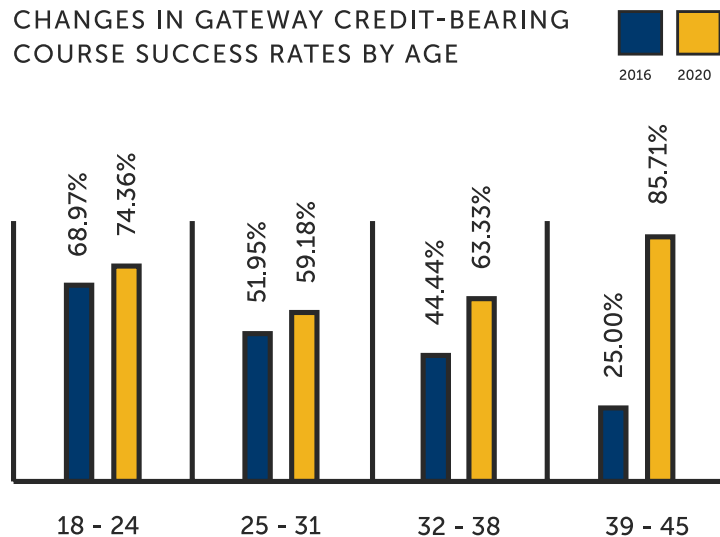


FIGURE 5. Students from all age groups taking gateway courses showed an increase in success rates. The most striking improvement was seen among students within the 39 to 45 age group. This group gained 60 percentage points in their success rates and had the highest passing rate of any age group.

Lessons Learned

Lee College enhanced its developmental math education experience by accelerating course completion, redesigning classrooms to increase student engagement and implementing clear corequisite course sequences. Through this journey, the administrators, faculty and staff at Lee College have faced a wide range of challenges and opportunities to reforming developmental mathematics education. Making these changes required taking thoughtful steps to understand student needs, obtain faculty buy-in while balancing stakeholder needs, and embracing an HSI identity.

UNDERSTANDING STUDENT NEEDS //////////////////////////////////////

In order to understand the needs of their students and, particularly, the needs of specific groups of students, faculty and administrators examined various institutional datasets. This allowed administrators and faculty to make informed decisions about developmental education changes, including how they enhanced mathematics pathways, teaching and support services. The institution was so committed to making data-informed decisions that its institutional research office has made student- and course-level data available to administrators and faculty in order to facilitate ongoing discussions of how to better serve students. Every year, Lee College gathers faculty and administrators to review data during a series of professional development opportunities. In addition, administrators also meet yearly with developmental education faculty members to review institutional data and strategically plan for the future.


Meanwhile, the institution also made a fundamental shift by moving from a deficit-based approach to an asset-based approach to education. Rather than posing student needs in a deficit manner where students need “fixing,” Lee College revamped its developmental math education courses to nurture student learning, including the further integration of peer mentoring, supplementary instruction and tutoring referrals. During strategic planning meetings, administrators and faculty made a concerted effort to address deficit language use around student abilities. In addition, course and support reforms were framed in terms of how the institution could shift structures to encourage success. As an HSI, this meant interrogating the needs of Latinx students and asking how the college could best serve all of its students, with emphasis on its majority population of Latinx students.



BALANCING STUDENT AND STAKEHOLDER NEEDS ////////////////

Developmental education impacts a wide range of stakeholders, both on and off campus, including students, faculty, staff, administrators, policymakers and other external partners. The Lee College leadership team must meet legislative and public mandates, maintain relationships with external partners and provide training and support for faculty and staff while ensuring that developmental math students have the resources to successfully transition from developmental to credit-bearing courses.

Faculty and administrators engaged in extensive dialogue and collaboration, coupled with thorough data analysis, to create a shared vision for progress and success in developmental math. With a common understanding of the challenge, Lee College administrators and faculty made developmental math education a priority for the college; administrators allocated financial resources, while faculty committed to being both creative and flexible in their redesign of curriculum and teaching. This collaboration included difficult conversations and an awareness of student needs. As an HSI, meeting student needs meant reflecting on the connections between developmental math education and Lee College's HSI status, including whether they were meeting the needs of traditionally underserved students.



Next Steps

The next steps for Lee College’s work in corequisite implementation are: (1) expanding student advising; (2) implementing mobile phone app technology; and (3) establishing formal structures to promote equity. These initiatives will make mathematics more accessible, improve degree-completion rates for Lee College students and maintain a focus on equity.

ESTABLISHING FORMAL STRUCTURES TO PROMOTE EQUITY AND COMMUNITY CULTURAL WEALTH //////////////////////////////////////

Lee College has made a commitment to equity and anti-racist educational approaches, and is looking for meaningful ways to embrace its identity as an HSI and make culturally relevant changes to developmental math education. In response to the needs of the Latinx community at Lee College and in Baytown, the college has identified a variety of tools and resources to increase equity and build community cultural wealth.

Lee College has established formal structures to examine and address equity, including a committee on equity and anti-racism, the college’s first campus climate survey and proactive use of data. Every faculty member on campus receives student outcome data disaggregated by race and gender and has opportunities to engage in discussions and professional development about teaching and learning. These formal structures, which allow faculty and staff to identify barriers to participation and success, are intended to build an inclusive campus climate for all. Going forward, Lee College will continue using these tools, along with professional development, to maintain focus on student experience and equity, both in developmental math courses and campus-wide.

Lee College seeks to increase human capital and purposefully serve its Latinx students by honoring community cultural wealth and taking an asset-based approach to redesigning mathematics pathways. Honoring community cultural wealth involves drawing on the knowledge, skills and abilities present within communities of color. Taking an asset-based approach will mean understanding student experiences and developing solutions that draw on students’ strengths to facilitate success in their math courses.

To support all of these efforts, Lee College has secured a number of grants and implemented programming centered on its designation as an HSI. These include a Title V Developing HSIs Program grant, an HSI STEM and Articulation Program initiative and the Puente Program, all of which have provided resources and support necessary to create a positive environment for

change. Building upon these successes, the leadership team will continue to make the critical shift by focusing on equity and taking an asset-based approach to developmental education.

EXPANDING STUDENT ADVISING //

The shift toward a corequisite model has meant a greater focus on student advising and relationship building. Lee College plans to expand its advising capacity by hiring more advisors to provide extra capacity during the four-week surge prior to fall 2021 and the three-week surge prior to spring 2022. Advisors will receive training on developmental math education, including a training related to equity issues and placement into corequisite developmental education. Growing capacity in this area will allow advisors to build meaningful relationships with students in order to enhance education and career planning.

IMPLEMENTING MOBILE PHONE APP TECHNOLOGY //

Lee College also plans to utilize mobile phones to make mathematics pathways more accessible. The college will introduce a mobile-friendly phone app that makes it easy for students to visualize their entire course sequence and stay on track with the appropriate math pathway. This new tool will help students, faculty and counselors/advisors quickly identify the appropriate math courses that meet students' desired end goal. The app is currently under development and will debut in fall 2021.

Notes



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RESOURCES

Lee College’s Math Pathways Site:

Learn more about Lee College’s mathematics pathways, including contact information. <https://www.lee.edu/eec/>

[Lee College’s Puente Program Site:](#)

Learn more about Lee College’s Puente Program, including contact information.

[The Charles A. Dana Center Mathematics Pathways Resource Site:](#)

Explore free tools and resources used by Lee College and partners for implementing mathematics pathways.

