Mathematics Pathways and Student Success: Transitioning through the Educational Ecosystem

Martha Ellis, Ph.D. Director, Higher Education Strategy, Policy, and Services, Dana Center

The Right Math at the Right Time for Each Student
About the Dana Center

The Charles A. Dana Center at The University of Texas at Austin works with our nation’s education systems to ensure that every student leaves school prepared for success in postsecondary education and the contemporary workplace.

Our work, based on research and three decades of experience, focuses on K–16 mathematics education with an emphasis on strategies for improving student engagement, motivation, persistence, learning and achievement.

We develop innovative curricula, tools, protocols, and instructional supports and deliver powerful instructional and leadership development. We work in 26 states.

The University of Texas at Austin
Charles A. Dana Center
The Dana Center Mathematics Pathways in Texas

A partnership of:

- The Charles A. Dana Center at The University of Texas at Austin
- All 50 community college districts in Texas, represented by the Texas Association of Community Colleges and the Texas Success Center
- Collaborating with the university systems

A systemic approach to improving student success by reforming developmental and gateway mathematics
DCMP Vision

All students have equitable access to and the opportunity for success in rigorous mathematics pathways that are aligned and relevant to their future aspirations, propelling them to upward economic and social mobility.

The DCMP seeks to ensure that ALL students in higher education will be:

• **Prepared** to use mathematical and quantitative reasoning skills in their careers and personal lives,

• **Enabled** to make timely progress towards completion of a certificate or degree, and

• **Empowered** as mathematical learners.
### Public Two Year Colleges

**Fall 2011 Cohort Total:** 128,702

<table>
<thead>
<tr>
<th>Enrollment Status</th>
<th>Full-time</th>
<th>Part-time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enroll</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Graduate in 3 years or less</td>
<td>8</td>
<td>4</td>
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<tr>
<td>Associate/Bachelor’s</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>Certificate</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Graduate in 4 to 6 years</td>
<td>9</td>
<td>6</td>
</tr>
<tr>
<td>Bachelor’s</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>Associate</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Certificate</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total graduates</td>
<td>17</td>
<td>10</td>
</tr>
<tr>
<td>Still enrolled after 6 years</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>No longer enrolled, no degree</td>
<td>29</td>
<td>36</td>
</tr>
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</table>

Number of every 100 Texas public two-year college students who earn a postsecondary degree or certificate at a two- or four-year institution within six years: **27**

### Public Universities

**Fall 2011 Cohort Total:** 72,600

<table>
<thead>
<tr>
<th>Enrollment Status</th>
<th>Full-time</th>
<th>Part-time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enroll</td>
<td>94</td>
<td>6</td>
</tr>
<tr>
<td>Graduate in 4 years or less</td>
<td>31</td>
<td>1</td>
</tr>
<tr>
<td>Graduate in 5 to 6 years</td>
<td>26</td>
<td>1</td>
</tr>
<tr>
<td>Total graduates</td>
<td>57</td>
<td>2</td>
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<tr>
<td>Still enrolled after 6 years</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td>No longer enrolled, no degree</td>
<td>28</td>
<td>3</td>
</tr>
</tbody>
</table>

Number of every 100 Texas public university students who earn a postsecondary degree within six years: **59**

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THECB, 2018 Texas Public Higher Education Almanac
The status quo is unacceptable.

Thousands of students fail higher education math courses every year.

Hundreds of thousands more students pass courses that do not prepare them for their futures.
The Dana Center identifies four major issues that negatively impact student success and completion and require structural reform across institutions.

- General misalignment of developmental and gateway mathematics courses with the needs of students and programs, particularly the use of College Algebra as the default gateway math course for most students
- Long developmental education course sequences
- Poor placement practices
- Inconsistent and incoherent applicability of gateway mathematics courses to programs of study across institutions
Which mathematics?

**Associate's Degrees Awarded**
- Require calculus: 23%
- Do not require calculus: 77%

**Bachelor's Degrees Awarded**
- Require calculus: 38%
- Do not require calculus: 62%

Author’s calculations based on data from the Texas Higher Education Coordinating Board, 2013: Degrees Earned by CIP Code.
Many students who begin on an algebra path never reach—or never intend to reach—calculus.

Students Who Take College Algebra

- 60% Do Not Take Any Form of Calculus
- 30% Take Business Calculus
- 10% Ever Take Calculus 1

Source: Dunbar, 2005.
What are Mathematics Pathways?

A course or sequence of courses that students take to meet the requirements of their program of study and prepare for future career.

- Quantitative Reasoning
- Statistics
- Calculus
Emerging Texas Math Pathways

**Meta-Major**

- Liberal Arts, Fine Arts, and Humanities
- Social Sciences and Social Services
- Nursing and Health Professions
- Business and Accounting
- Teaching and Education
- Science, Technology, Engineering, and Math

**Math Pathway**

- Quantitative Reasoning Pathway—Math 1332 Contemporary Math
- Statistical Reasoning Pathway—Math 1342 Elementary Statistical Methods
- Business Pathway—Math 1324 Mathematics for Business
- Teacher Pathway—Math 1350 Fundamentals of Math I (Math 1314 is a prerequisite)
- STEM Pathway—Math 2413 Calculus I (with Math 1314 College Algebra and 2312 Pre-Calculus if needed)
Mathematics College Readiness

- Percentage of Texas community college students that are required to take developmental mathematics courses.

40%

Texas Higher Education Coordinating Board Developmental Education Accountability Measures Data, 2017
Mathematics College Completion

Percentage of students referred to developmental education who earned a credit in a college mathematics course in two years.

19%

Texas Higher Education Coordinating Board Developmental Education Accountability Measures Data, 2017
Why does developmental education reform matter? Co-requisite remediation increases completion and improves efficiency.

**Prerequisite Remediation**
- 100 Enroll in MAT 030
- 41 Enroll in MAT 060
- 23 Enroll in MAT 090
- 13 Enroll in MAT 099
- 6 Enroll in college-level course
- 4 Complete college-level course
- 4 Successful completers
- 5 Semesters to complete
- 46 Enrollments/completer

**Co-requisite remediation**
- 100 Enroll in college-level course and enroll in co-req lab
- 54 Complete college-level course
- 54 Successful completers
- 1 Semesters to complete
- ~4 Enrollments/completer

= 10 students
What we know: Dev Ed Reform Matters

- Pilots do not work
- Work at scale rather than scaling up
- Acceleration improves student outcomes
- Structure matters—pathways
- Pedagogy matters—active learning and growth mindset
Dana Center Principles for Mathematics Pathways

**Post-Secondary**

**Quick structural change**

- *All students, regardless of college readiness, enter directly into mathematics pathways aligned with programs of study*

- *First college-level math requirement completed in the first year of college*

**Continuous improvement**

- *Strategies to support students as learners are integrated directly into courses and aligned across the institution*

- *Evidence-based curriculum and pedagogy*
Completion of College Level Math Course in Their First Year at Texas Community Colleges

- **7000 more** FTIC students completed a college level mathematics course in their first year while overall community college enrollment decreased.

- From 2013 to 2017
  - THECB, 2018
Texas Public Universities, Mathematics in the Core Curriculum

Core Curriculum Entry-Level Math Course at Texas Universities, 2010-2017

- Math 1342 Elementary Statistical Methods
- Math 1332 Contemporary Mathematics
- Math 1314 College Algebra
National Policy, Higher Education, and Content Organizations Support Mathematics Pathways
Texas Transfer Context

...the percent of bachelor’s completers that had community college credit on their transcripts. Almost 40% had 30+ SCH.

...the average number of credits accumulated by a bachelor’s degree completers


the percent of bachelor’s completers that had community college credit on their transcripts. Almost 40% had 30+ SCH.

...the average number of credits accumulated by a bachelor’s degree completer.


Total Two-Year College Transfers to University by Ethnicity

- 38.5%
- 38.8%
- 11.6%
- 5.8%
- 5.3%

Other
White
Hispanic
African American
Asian

THECB, 2018 Texas Public Higher Education almanac
Why approach 60x30TX regionally?

• Regions and institutions differ in many ways
• However, institutional actions and outcomes are embedded in regional context
  • High school feeder patterns
  • Transfer networks
  • Local labor market
• Institutional target-setting is improved by considering regional context
• Encourages tactical planning
Regional Approach
## Dana Center Principles for Mathematics Pathways

### Post-Secondary

**Quick structural change**

- Enter mathematics pathways aligned to programs of study

- First college-level math in the first year of college

**Continuous improvement**

- Integrated student success strategies

- Evidence-based curriculum and pedagogy

### K-12

**Quick structural change**

- Align high school course offerings to post-secondary gateways

- College-ready-trajectory math beginning no later than Grade 11 and continuing through graduation

**Continuous improvement**

- Integrated student success strategies

- Evidence-based curriculum and pedagogy
## HB 5 Endorsements

<table>
<thead>
<tr>
<th>Arts and Humanities</th>
<th>Public Service</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business and Industry</td>
<td>STEM</td>
</tr>
<tr>
<td>Multidisciplinary</td>
<td></td>
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### Emerging Texas Math Pathways

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<td>Quantitative Reasoning Pathway—Math 1332 Contemporary Math</td>
</tr>
<tr>
<td>Social Sciences and Social Services</td>
<td>Statistical Reasoning Pathway—Math 1342 Elementary Statistical Methods</td>
</tr>
<tr>
<td>Nursing and Health Professions</td>
<td></td>
</tr>
<tr>
<td>Business and Accounting</td>
<td>Business Pathway—Math 1324 Mathematics for Business</td>
</tr>
<tr>
<td>Teaching and Education</td>
<td>Teacher Pathway—Math 1350 Fundamentals of Math I (Math 1314 is a prerequisite)</td>
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Readiness for Mathematics Pathways

- Algebra I
- Geometry
- Algebra II
- Algebra II equivalent
- Pre Calculus
- Quantitative Reasoning
- College Prep Mathematics Course
- AP/IB Calculus
- AP/IB Statistics
- Dual Credit
“Building a strong network of practitioners and policymakers to collaborate, share resources, and create momentum for change is crucial to the implementation, scaling, and sustainability of multiple mathematics pathways. To this end, the Dana Center designed an intentional process that empowers faculty to lead at the state level, engages multiple stakeholders, and is coordinated and aligned across institutions and systems.”
Contact us

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For more information on the Dana Center, see  
www.utdanacenter.org  
www.dcmathpathways.org

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