The Right Math at the Right Time: National Context

Michigan Student Success Network
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Why is it the “Right Time”?

- Sweeping state policy reforms
- Prioritization in the national mathematics community
- Completion agenda
- Better understanding of innovation and change efficacy
- Common Core State Standards

The Charles A. Dana Center
at the University of Texas at Austin

Texas Association of Community Colleges
Why is it the “Right Time”? 

Shifting focus on outcomes instead of inputs in higher education
- Foundations
- Legislatures
- Policy organizations

- Completion agenda
- Sweeping state policy reforms
- Better understanding of innovation and change efficacy
- Common Core State Standards
Why is it the “Right Time”?  

Connecticut: Only one level of developmental education allowed  
Florida: Developmental education is optional for students regardless of place

- Sweeping state policy reforms
- Prioritization in the national mathematics community
- Better understanding of innovation and change efficacy
- Common Core State Standards
Why is it the “Right Time”?

Sweeping state policy reforms

Core recommendations of high profile reports:
- President’s Council of Advisors on Science and Technology,
- The Carnegie Corporation-Institute for Advanced Study Commission on the Future of American Mathematics, and
- The National Research Council’s Math 2025 reports
Why is it the “Right Time”?

Sweeping state policy reforms

Prioritization in the national mathematics community

Better understanding of innovation and change efficacy

Summary evaluation of Achieving the Dream
- Lots of innovation produced very small effects on student outcomes
- The next round of innovation needs to focus on classroom level interventions.
- What are students learning and how?
Why is it the “Right Time”?

- Sweeping state policy reforms
- Completion agenda
- Common Core State Standards

- Broadening of content standards to include more focus on statistics & probability
- Emphasis in practice standards on modeling and flexible understanding of concepts.
What is the “Right Math”?  

College algebra and traditional developmental math sequences were designed in the 1950’s to prepare students for calculus.

• But only a small percentage of the students have any intention of going on to calculus!
What is the “Right Math”?  

Students Who Take College Algebra

<5%

Ever Take Calculus 1

What is the “Right Math”?

Students Who Take College Algebra

<5%

Virtually no students who pass college algebra ever start Calculus III

What is the “Right Math”? 

Students Who Pass Pre-Calculus 

- Ever Take Calculus 1: 30-40%

What is the “Right Math”?

Students Who Take College Algebra

- 10% In a major that requires Calculus

Mathematics Course Enrollment

Conference Board of Mathematics Sciences, 2005

- Dev Ed Math: 55%
- Pre-Calculus: 19%
- Liberal Arts Math: 13%
- Calculus: 6%
- Statistics: 7%
Conference Board of Mathematics Sciences, 2005

- Pre-Calculus: 49%
- Liberal Arts Math: 33%
- Statistics: 18%
Math in the work place

Table 3. Descriptives: Math, Reading, Writing, and Documents

<table>
<thead>
<tr>
<th></th>
<th>All</th>
<th>Hi WC</th>
<th>Lo WC</th>
<th>Hi BC</th>
<th>Lo BC</th>
<th>Service</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math (α=0.81)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Any math</td>
<td>0.94</td>
<td>0.95</td>
<td>0.97</td>
<td>0.94</td>
<td>0.91</td>
<td>0.88</td>
</tr>
<tr>
<td>2. Add/subtract</td>
<td>0.86</td>
<td>0.93</td>
<td>0.90</td>
<td>0.87</td>
<td>0.78</td>
<td>0.73</td>
</tr>
<tr>
<td>3. Mult./divide</td>
<td>0.78</td>
<td>0.89</td>
<td>0.82</td>
<td>0.81</td>
<td>0.65</td>
<td>0.57</td>
</tr>
<tr>
<td>4. Fractions</td>
<td>0.68</td>
<td>0.82</td>
<td>0.68</td>
<td>0.70</td>
<td>0.58</td>
<td>0.40</td>
</tr>
<tr>
<td>More advanced</td>
<td>0.22</td>
<td>0.35</td>
<td>0.09</td>
<td>0.41</td>
<td>0.19</td>
<td>0.04</td>
</tr>
<tr>
<td>5. Algebra I</td>
<td>0.19</td>
<td>0.30</td>
<td>0.08</td>
<td>0.36</td>
<td>0.16</td>
<td>0.04</td>
</tr>
<tr>
<td>6. Geometry/trig</td>
<td>0.14</td>
<td>0.20</td>
<td>0.05</td>
<td>0.29</td>
<td>0.15</td>
<td>0.02</td>
</tr>
<tr>
<td>7. Statistics</td>
<td>0.11</td>
<td>0.22</td>
<td>0.05</td>
<td>0.10</td>
<td>0.06</td>
<td>0.02</td>
</tr>
<tr>
<td>8. Algebra II</td>
<td>0.09</td>
<td>0.14</td>
<td>0.03</td>
<td>0.16</td>
<td>0.08</td>
<td>0.02</td>
</tr>
<tr>
<td>9. Calculus</td>
<td>0.05</td>
<td>0.08</td>
<td>0.01</td>
<td>0.08</td>
<td>0.05</td>
<td>0.01</td>
</tr>
<tr>
<td>Mean Level</td>
<td>4.11</td>
<td>4.9</td>
<td>3.7</td>
<td>4.8</td>
<td>3.7</td>
<td>2.8</td>
</tr>
</tbody>
</table>

A Burial Ground...

Students Passing a Math Course that Counts Toward an Associate’s Degree

Fall 2010 enrollments in math courses that students could apply toward a degree → students who remained enrolled until the end of the term → students who received a passing grade

About 17,600 African American students
- 70% (12,300 students)
- 41% (7,300 students)

About 108,700 Hispanic/Latino students
- 75% (81,900 students)
- 49% (53,500 students)

About 98,600 White students
- 80% (78,500 students)
- 60% (58,900 students)

source: Passing when it counts. EdSource Issue Brief, February 2012
www.edsource.org/pub12-passing-when-it-counts.html
Students Passing a Math Course that Counts Toward an Associate’s Degree

### Gateway Math Course Completion

_A sample from Fall 2009 Cohort_

<table>
<thead>
<tr>
<th>Course</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Statistics</td>
<td>80%</td>
</tr>
<tr>
<td>Quantitative Reasoning</td>
<td>76%</td>
</tr>
<tr>
<td>College Algebra</td>
<td>62%</td>
</tr>
</tbody>
</table>

_Cohort total: 48,000_

**source:** *Unpublished four-year system data from a state in the U.S. southeast*
### Why Acceleration?

#### Developmental Education Pipeline at Public Two-Year Colleges

**Cohort**

<table>
<thead>
<tr>
<th>Description</th>
<th>Fall 2007</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cohort total:</td>
<td>99,097</td>
</tr>
<tr>
<td>Of students below state standard* ...</td>
<td><strong>100</strong></td>
</tr>
<tr>
<td>... in math</td>
<td></td>
</tr>
<tr>
<td>Enrolled in developmental education</td>
<td>83</td>
</tr>
<tr>
<td>Achieved college readiness</td>
<td>39</td>
</tr>
<tr>
<td>Attempted first college-level course</td>
<td>21</td>
</tr>
<tr>
<td>Successfully completed first college-level course</td>
<td><strong>15</strong></td>
</tr>
</tbody>
</table>

*Source: Texas Higher Education Coordinating Board*
Why Acceleration?

Two-year cohort data from a typical large community college in Texas

Arithmetic
- Passed: 1864 (100%)

Beginning Algebra
- Passed: 1229 (65%)

Intermediate Algebra
- Passed: 994 (53%)

Completed Developmental Math sequence
- Passed: 672 (36%)
- Passed, but did not enroll in next course: 447 (24%)
- Failed course or withdrew: 343 (18%)

Failed course or withdrew:
- Arithmetic: 1864 (100%)
- Beginning Algebra: 994 (53%)
- Intermediate Algebra: 343 (18%)

Two-year cohort data from a typical large community college in Texas
Putting it all together: Policy level

Joint statement of principles: Dana Center, Jobs for the Future, Complete College America, and Education Commission of the States
Diversifying Gateway Courses

Principle 2. The content in required gateway courses should align with a student’s academic program of study — particularly in math.

Principle 3. Enrollment in a gateway college-level course should be the default placement for many more students.

Principle 4. Additional academic support should be integrated with gateway college-level course content — as a co-requisite, not a pre-requisite.
Principle 5. Students who are significantly underprepared for college-level academic work need accelerated routes into programs of study.
Subpopulations of Students

Cullinane, J. (2012, July). Developmental education structures designed for the college readiness continuum: Aligning the co-requisite model and student needs. The Charles A. Dana Center at the University of Texas at Austin.
Accelerated mathematics pathways for developmental students

Prominent examples of multiple mathematics pathways

- New Mathways Project – Dana Center
- Statway/Quantway – Carnegie Foundation
- New Life Project – AMATYC
- Statpath – Los Medonos Community College, CA
- Developing Mathematics Thinking, Austin Community College, TX
New Mathways Project: Core Principles

A systemic approach to improving student success and completion by reforming developmental and gateway mathematics based on four fundamental principles:

1. **Multiple pathways** with relevant and challenging mathematics content aligned to specific fields of study.

2. **Acceleration** that allows students to complete a college-level math course more quickly than in the traditional developmental math sequence.

3. Intentional use of strategies to help students **develop skills as learners**.

4. Curriculum design and pedagogy based on **research and proven practice**.
The NMP Courses

Foundations of Mathematical Reasoning

Frameworks for Mathematical and Collegiate Learning
EDUC 1300 or PSYC 1300 taken concurrently (1 term)

Quantitative Reasoning
MATH 1332 (1 term)

Statistical Reasoning
MATH 1342 (1 term)

STEM Prep Pathway
(2 terms)
currently in development

Students enter Calculus sequence

non-transferable courses

transferable courses
Key Characteristics of NMP Courses

- Common entry point: students create a completion plan and select the appropriate math pathway through a structured process in the student success course.
- Designed as pathways to create a coherent and consistent experience for students and reinforce retention across terms.
- Student success strategies embedded in math courses to apply and reinforce concepts from the student success course.
Key Characteristics of NMP Courses

- Strong embedded support for instructors
- “College-level” content integrated into developmental course so that students are challenged and engaged
- Courses designed to support the development of strong reasoning and problem-solving skills
Status of Implementation

In Texas:

- Implementation Resources  Fall 2012
- Statistics Pathway  Fall 2013
- Quantitative Reasoning Pathway  Fall 2014
- STEM Pathway  Fall 2015

Outside of Texas

- Beginning in Fall 2014
Q&A
Why is it so hard to scale educational innovations?
#1

Design the innovation for scale

Innovations are socially embedded in:
- Culture and norms
- Formal regulation
- Informal institutions,
- Labor force
- Power structures
Challenge: How do we get the right student in the right path?

Challenge: How do we get statewide approval for new courses?
Foundations of Mathematical Reasoning

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#2
Design the Initiative for Scale

3 tiers of engagement
#3 Giving Permission
why is it so hard to scale educational innovations?
Systemic change in normative practice
A few other implementation tasks

- Ensuring rigor of courses
- Aligning math to programs of study/metamajors
- Ensuring courses meet state/institutional requirements for credit/transfer/college readiness
- Developing the workforce to teach a different mix of courses
- Working with advisors to understand/promote multiple pathways
- Outreach to students, faculty, staff @ 2-yrs
- Outreach to faculty, staff @ 4-yrs
Contact Information

- General information about the Dana Center: www.utdanacenter.org
- Higher Education work: www.utdanacenter.org/higher-education/new-mathways-project/
- To receive monthly updates about the NMP, contact us at: mathways@austin.utexas.edu
- Staff contacts:
  - Jenna Cullinane: jenna.cullinane@austin.utexas.edu
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 two decades of experience, focuses on K-16 mathematics and science education with an emphasis on strategies for improving student engagement, motivation, persistence, and achievement.

We develop innovative curricula, tools, protocols, and instructional supports and deliver powerful instructional and leadership development.
NMP: A Joint Initiative

- Charles A. Dana Center at the University of Texas at Austin
  - Over 20 years of state and national leadership in mathematics education
  - Led original curriculum development of Statway and Quantway in partnership with the Carnegie Foundation
  - Staff: math educators, policy experts, student success experts

- Texas Association of Community Colleges
  - Represents all 50 community college systems
  - Represents the community college interest in state policy and budgeting