Systems Approach to Scaling Mathematics Pathways

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NASH TS3, Denver, CO

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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.
All Students Prepared Enabled Empowered

Post-secondary Mathematics

Mismatch of Content + Long Course Sequences

Mathematics Pathways
Principles 1 & 2: Structural and policy changes to align and support timely completion
Principles 3 & 4: Continuous improvement to ensure high-quality effective instruction

Goal

Prepared

Enabled

Empowered

Dana Center Mathematics Pathways (DCMP)
A mathematics pathway is a mathematics course or sequence of courses that students take to meet the requirements of their program of study. The concept of math pathways applies to pathways for both college-ready and underprepared students.
**DCMP Model**

**Institutions implement structural and policy changes** quickly and at scale.

Mathematics pathways are structured so that:

- **Principle 1:** All students, regardless of college readiness, enter directly into mathematics pathways aligned to their programs of study.
- **Principle 2:** Students complete their first college-level mathematics requirement in their first year of college.

**Institutions and departments engage in a deliberate and thoughtful process of continuous improvement** to ensure high-quality, effective instruction.

Students engage in a high-quality learning experience in mathematics pathways that are designed so that:

- **Principle 3:** Strategies to support students as learners are integrated into courses and are aligned across the institution.
- **Principle 4:** Instruction incorporates evidence-based curriculum and pedagogy.
Systems approach to the DCMP model

**NATIONAL**
- **GOAL:** Legitimize math pathways through professional associations and mathematics leadership

**STATE/SYSTEM**
- **GOAL:** Coordinate policy, institutional and organizational efforts across state/system to promote DCMP model

**REGIONAL**
- **GOAL:** Engage and support regional stakeholders to support math pathways—particularly regarding transfer and applicability policies

**INSTITUTIONAL**
- **GOAL:** Build tools and services that help colleges to implement systematic reform

**FACULTY & CLASSROOM**
- **GOAL:** Develop professional learning and curricular resources informed by faculty

All students are prepared, enabled, and empowered.
From scaling up to working at scale

- Faculty-driven
- Administrator-supported
- Policy-enabled
- Culturally-reinforced
What do leaders in mathematics say?

“Unfortunately, there is often a serious mismatch between the original rationale for a college algebra requirement and the actual needs of students who take the course. A critically important task for mathematics sciences departments at institutions with college algebra requirements is to clarify the rationale for requirements, determine the needs of students, and ensure that department’s courses are aligned with these findings.”

—Mathematics Association of America, Committee on the Undergraduate Program in Mathematics
A vision for tomorrow’s mathematical sciences departments:

- To narrow the gap between mathematics as used in the workplace and mathematics as experienced in our classrooms.
- To make mathematics an essential partner to other disciplines with broader responsibility for quantitative education across the institution.
- To ensure that postsecondary mathematics is a potent resource for students’ upward social and economic mobility.
Intra-institutional Implementation: Math Pathways Within An Institution
Inter-institutional Implementation: Math Pathways Across Systems
Change at scale requires work at multiple levels of the system.

Systems and leaders at higher levels enable broad, large-scale action.

Local action informs and influences levels above.
DCMP Resource Site

www.dcmathpathways.org

The Right Math for the Right Student at the Right Time

The Dana Center Mathematics Pathways seeks to ensure that ALL students in higher education will be:
- Prepared to use mathematical and quantitative reasoning skills;

It takes coordinated action across all...
- Levels of the system (national, state, institution, classroom);

In order to...
- Redesign course and institutional structures that deter success;
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 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.
Finding a Balance: Purposeful Mathematics Pathways

NASH TS3 Convening
April 13-14, 2017
Denver, Colorado

Nancy S. Shapiro
Associate Vice Chancellor
What problem are we trying to solve in Maryland?

• Intermediate Algebra is the “graveyard” for non-STEM majors

• Approximately 71% of Maryland’s community college students test into developmental math courses

• Existing regulations drove community college students toward math courses that did not align with the requirements of their majors and resulted in high failure and drop-out rates

• USM institutions had multiple mathematics pathways, but community colleges did not

• Inefficient Transfer from community college to 4-year institutions
Can you relate?
Think. Pair. Share.

• Do any of these issues resonate with you on your campus or in your state? If so, which ones?
• Are there other issues challenging your systems?
Maryland’s Goals for Undergraduate Mathematics

• Reduce the number of students taking remedial math

• Increase the percentage of students who successfully complete remedial math within their first year of college

• Increase the percentage of first year freshmen who successfully complete a math course that fulfills a general education requirement in their first year

• Develop math pathways to place students in more appropriate courses for their educational goals and for success in their degree program area

• Provide better advising for incoming freshmen and returning non-traditional students
Cost of Remedial Education

*College and Career—Are Maryland Students Ready* (Maryland Department of Legislative Services February 2015)

- Community Colleges: $7000/student (for a total of $75.3 Million)
- USM: $9000/student (for a total of $14.0 Million)
What is the “right math”? 

Community College Student Enrollment into Programs of Study

- Require Calculus: 20%
- Do not require Calculus: 80%

Four-Year Student Enrollment into Programs of Study

- Require Calculus: 28%
- Do not require Calculus: 72%

Think. Pair. Share.

Consider the last two slides: cost of remediation and enrollments.

• How would you go about getting buy-in to change a dysfunctional system?

• What types of evidence needs to be collected to influence policy changes?

• Who is responsible for collecting the data? From whom?
Achieving Buy-In For Policy Changes

Leadership from the Top
- Intersegmental Chief Academic Officers
- MMRI Steering Committee

Engaging Faculty
- Statewide Mathematics Group
- MMRI Workgroup
- Campus-level committees and task forces
Engaging Faculty: Statewide Mathematics Group

- Mathematics faculty representatives from all higher education institutions are invited (Public, Private, Community College, 4-year)

- Sample Types of Work:
  - Established a core definition for the mathematic general education and recommended core course components for the mathematic general education courses
  - Identified the expected student outcomes for the general education mathematics courses and developed potential methods of measuring student general education competencies or outcomes
  - Shared individual institutions' mathematics general education courses and discussed how these traditional general education courses meet the competencies
Policy Change: New General Education Language

<table>
<thead>
<tr>
<th>Old Language</th>
<th>New Language</th>
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<tbody>
<tr>
<td>One course in mathematics at or above the level of college algebra</td>
<td>One course in mathematics, having performance expectations demonstrating a level of mathematical maturity beyond the Maryland College and Career Ready Standards in Mathematics (including problem-solving skills, and mathematical concepts and techniques that can be applied in the student’s program of study).</td>
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Policy Takeaways

• Take advantage of existing structures and relationships

• Space or forum for open and frank dialogue is key

• Essential Conditions
  • Common understanding of the problem
  • Shared belief that the problem is important and needs to be addressed
Mathematics Pathways: A Planning & Implementation Template for Success

NASH TS3
April 13-14, 2017
Randy Schulte
Associate Vice Chancellor
The Tennessee Two-Step

1. Realignment of Math Pathways
2. Implementation of Corequisite Remediation
TS3 System-wide Goals for Student Success in Mathematics

• Reduce the number of students taking remedial math
• Increase the percentage of students who successfully complete remedial math within the first year of college
• Increase the percentage of first year freshmen who successfully complete a credit-bearing math course in the first year
• Develop math pathways to place students in appropriate courses for their degree programs
• Provide better advising for incoming freshmen to support these goals
A GOAL WITHOUT A PLAN IS JUST A WISH

Antoine de Saint-Exupery
STEP ONE: REALIGNMENT OF MATHEMATICS PATHWAYS

• System-wide meetings with
  • Mathematics Academic Leaders
  • Mathematics Faculty

• Tennessee Transfer Pathways curricula development and revision
  • Discipline-specific Academic Leaders
  • Discipline-specific Faculty
- MATH 1000 - Bridge to Algebra
- MATH 1010 - Quantitative Reasoning
- MATH 1530 - Statistics
- MATH 1630 - Discrete Math
STEP TWO: Implementation of Mathematics Corequisite Remediation

• Data Analytics
• Collaboration
• Planning & Implementation
Planning & Implementation Template

1. Key Accomplishments
2. Challenges
3. Steps Forward
4. Who and When?
5. Metrics
6. Needs Assessment
Planning & Implementation Template

1. **KEY ACCOMPLISHMENTS**

- Describe major steps enacted so far to realize this initiative.
  - Successes
  - Effective Practices
  - Models
Planning & Implementation Template

2. CHALLENGES

• Pedagogy
• Scheduling
• Staffing
• Technology
• Outreach
• Support
Planning & Implementation Template

3. STEPS FORWARD

• What additional steps need to be taken to fully implement the practice?
  • Policy
  • Process
  • Goals
  • Strategies
## 4. WHO AND WHEN?

<table>
<thead>
<tr>
<th>INITIATIVE CATEGORY</th>
<th>DESCRIPTION OF TASK</th>
<th>PRIMARY RESPONSIBILITY</th>
<th>TIMEFRAME to IMPLEMENTATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology</td>
<td>Identify online supplemental instructional software</td>
<td>Coordinator of Mathematics Learning Support</td>
<td>Spring 2017 – research Fall 2017 – pilot Spring 2018 – go to scale</td>
</tr>
</tbody>
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5. Metrics

• How will we know that this practice is making progress?
  • Measurable targets
  • Trajectories on timeline
  • Accountability
Planning & Implementation Template

6. Needs Assessment

• Identify and list what you need to fully actualize the initiative.
  • Physical resources
  • Human capital
  • Data
  • External assistance
RESULTS:

In 2015, Tennessee abolished prerequisite remediation. Now remedial students take the normal college math or writing course, but alongside it, get extra workshops and tutoring.

Co-requisite remediation makes a huge difference. In the old system, only 12 percent of students who began in remedial math completed a college-level math class in their first year. Now 55 percent do.

https://www.nytimes.com/2017/03/28/opinion/at-college-a-guided-path-on-which-to-find-oneself.html?_r=0