


Dana Center
Mathematics
PATHWAYS

Multidisciplinary Discussions



The University of Texas at Austin
Charles A. Dana Center www.dcmathpathways.org



Purpose
Support institutional leaders to plan for multidisciplinary discussions to align mathematics pathways to programs of study.

Audience
Individuals and teams who are leading math pathways work, which may include faculty, administrators, student services staff, and institutional researchers.

Facilitated by
Paula Talley
Charles A. Dana Center

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Using this webinar

This webinar is designed to convey information and support discussion, reflection, and action.

View this webinar individually or use it with a group to structure discussion and planning. Periodically, there will be prompts for activities, including:

- Discussion/reflection
- Practice
- Plan for action

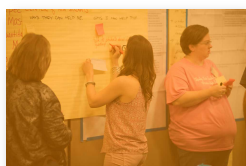
For each webinar, pause at these points as long as you wish.

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Outcomes

Participants will:

- Understand the importance of engaging partner disciplines to align mathematics pathways to programs of study.
- Use tools and resources to support alignment of mathematics pathways to programs of study at your institutions.



Importance of Engaging Partner Disciplines

Pathways

- Creating clearly structured, educationally coherent program pathways that lead to students' end goals.
- Rethinking instruction and student support services in ways that facilitate students' learning and success as they progress along these paths.

Bailey, T. R., Jaggars, S. S., & Jenkins, D. (2015). *Redesigning America's community colleges: A clearer path to student success*. Harvard University Press.

Definition of *math pathway*

... a mathematics course or sequence of courses that students take to meet the requirements of their programs of study.

The concept of math pathways applies to *all* students.

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.

The Dana Center Mathematics Pathways 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.

Activity: Discussion/reflection



Take a few minutes to discuss with your colleagues or reflect individually:

1. What current structures are in place at your institutions for DCMP Principles 1 and 2?
2. What would have to be done to better align your mathematics courses to field of study?

When you are finished, proceed to the next section.

Multidisciplinary discussions are essential!

Alignment of Mathematics Pathways to Programs of Study

- Design
- Implementation
- Evaluation
- Ongoing Improvement



Professional associations of mathematics say...

Faculty in other disciplines particularly value introductory mathematics courses that focus on skills used in their disciplines. All guides recommended employing a broad range of classic and contemporary applications that promote awareness of connections to other subjects, strengthen each student's ability to apply the course material in other contexts, and enhance student perceptions of the relevance of mathematics to the modern world (p. 16).

Mathematical Association of America. (2015). *A common vision for undergraduate mathematical science programs in 2025*.

Professional associations of mathematics say...

Faculty in disciplines outside mathematics rarely ask their students to find the equation of the line that passes through two given points. But social scientists, for example, will expect students to recognize a linear pattern in a set of data, interpret the parameters of the line of best fit, and use the equation of the line to answer questions in the context of a real-world scenario. Mathematical sciences departments should be aware of applications used in other disciplines and adjust their general education and introductory courses accordingly (p. 21).

Mathematical Association of America. (2015). *A common vision for undergraduate mathematical science programs in 2025*.

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Value of Discipline Engagement for Mathematics Faculty

- From Burdman, P. (2015). *Degrees of Freedom*. Part 1, pp. 11-12
 - "...mathematics, as taught by mathematicians, is seen as a separate and arcane discipline by a large fraction of the academic community."
 - "cultivating mathematicians' understanding of how math is used outside of math departments has been seen as vital to the future of mathematics."
 - "Increasing involvement of other disciplines in discussion about math may be eroding mathematicians' traditional veto power over quantitative requirements. Other departments are really questioning learning goals."

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Current barriers

- Institutional structure
- Cultural norms and assumptions
 - Openness to working together
 - Perception as a service discipline
- Language



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Aligning Mathematics Pathways to Programs of Study

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Guide to Aligning Math Pathways to Programs of Study

	Part I Current Program Requirements <small>pp. 2-6</small>	Part II Review External Recommendations <small>pp. 7-10</small>	Part III Action Steps to Maximize Scale <small>pp. 11-13</small>
Purpose	Gather current information about math course requirements and advising practices	Inform changes possibly made to course requirements and advising practices	Identify short- and long-term action steps to scale math pathways implementation
Who Is Involved	Leadership team, with input from partner discipline leads or department chairs	Leadership team	Leadership team
Necessary Resources	1. Template for Alignment of Mathematics Pathways Inventory 2. Sample Math Pathways List 3. Engaging Partner Disciplines: Multidisciplinary Discussion Tools	1. Institutional Transfer Data 2. State-Level Math Inventory Guide (if available) 3. Program of Study Briefs (multiple briefs available)	1. Alignment of Mathematics Pathways Inventory

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Part I: Examine the current requirements

Purpose	Who Is Involved	Necessary Resources
Gather current information about math course requirements and advising practices	Leadership team, with input from partner discipline leads or department chairs	1. Template for Alignment of Mathematics Pathways Inventory 2. Sample Math Pathways List 3. Engaging Partner Disciplines: Multidisciplinary Discussion Tools

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Overview of Part I

1. Complete the inventory.
2. Code the inventory.
3. Identify high-enrollment majors at your college.
4. Review the *Sample Math Pathways* list.
5. Engage your colleagues.
6. Update the guide.
7. Review current requirements.

Activity: Discussion/reflection

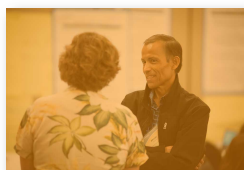
Take a few minutes to discuss with your colleagues or reflect individually:



1. Reflect on Part I. What do you see as the biggest challenges for you, your team, and/or your institution?
2. Brainstorm solutions to address these challenges.

When you are finished, proceed to the next section.

Fostering Productive Discussions



Fostering productive multidisciplinary discussions

- Identify a problem of mutual concern and work toward a shared goal.
- Set norms for working together.
- Co-create a shared understanding
 - Data, accessible language
- Honor expertise.
- Plan for the discussion.

Engaging partner disciplines

Engaging Partner Disciplines: Multidisciplinary Discussion Tools

Purpose: This tool is a collection of templates that faculty and administrators can use to prepare for and implement multidisciplinary discussions focused on *identifying a default mathematics course requirement that is most relevant for each program of study.*

Audience: This tool is intended for use with a small group that includes mathematics faculty, partner discipline faculty, and related department leadership.

The tool contains the following parts:

- Meeting Preparation Advice
- Meeting Agenda Template
- Mathematics Department Discussion Template
- Discipline Team Discussion Template
- Survey of Mathematical Skills
- Sample Timeline and Activities

Who needs to be included?

Meeting Preparation Advice

Establish roles.

- **Meeting lead:** This person can be someone from either the mathematics department or the departmental team and is responsible for organizing logistics and facilitating agenda.
- **Math lead:** The math lead should have familiarity with the learning outcomes for all entry-level math courses and is responsible for bringing appropriate resources to the discussion.
- **Discipline team:** The discipline team should be prepared to discuss the quantitative skills students in your programs need and the way in which mathematics is used in jobs in your field.
- **Others?**

Complete preparation as outlined in the appropriate discussion template.

- Review either the Mathematics Department Discussion Template or the Discipline Team Discussion Template.
- Jot down initial thinking and/or bring available documentation to the discussion.

How should the meeting be structured?

Meeting Agenda Template	
5 minutes	<p>Set the charge.</p> <p><i>Identify shared goal:</i></p> <ul style="list-style-type: none"> - Work toward identifying a default mathematics course requirement that is most relevant for each program of study. <p><i>Outcome for this specific meeting:</i></p> <ul style="list-style-type: none"> - Develop a shared understanding of the needs for mathematics in the program(s) of study as well as topics covered in the mathematics courses. <p><i>Establish group norms:</i></p> <ul style="list-style-type: none"> - Recognize that everyone has expertise. - Honor requests for additional thinking time so everyone can participate. - Use specific examples and agree on definitions. - Presume positive intentions.
10 minutes	<p>Develop common understanding of the context.</p> <ul style="list-style-type: none"> - Share relevant student success data for mathematics pathways. - Identify the specific programs of study that will be part of this discussion.

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How should the mathematics department prepare?

Mathematics Department Discussion Template
<p>Preparation: Consider bringing the following resources to the meeting.</p> <ul style="list-style-type: none"> • Relevant student success data for mathematics pathways. • Examples of the mathematics problems students will encounter in each course. • Illustration of the ways you incorporate the partner discipline into the existing mathematics courses. • Program of Study briefs, recommendations of professional associations, meta-major frameworks, etc. • MAA's partner discipline reports: MAA (2004), <i>The Curriculum Foundations Project</i>; Voices of the Partner Disciplines; and MAA (2011), <i>Partner Discipline Recommendations for Introductory College Mathematics and the Implications for College Algebra</i>.

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How should the partner discipline prepare?

Discipline Team Discussion Template
<p>Preparation: Describe what your students need to be quantitatively prepared for your department's programs of study.</p> <ul style="list-style-type: none"> - What are the mathematical skills used in careers/jobs that students in your discipline go on to pursue? - What are the mathematical skills and abilities that students need to learn in entry-level mathematics courses to prepare for upper-division coursework in your discipline? <i>The next section, Survey of Mathematical Skills, may be useful here.</i> - What applications of mathematics do students use most frequently in your discipline? - Do some of your students display "math anxiety" – delay course taking, avoid quantitative assignments, have fixed mindset about math ability, etc.? How can you partner with the math department to address these concerns? - How do you think your discipline's models and problems could be included in entry-level math courses? - Are there any programs of study in this discipline that have mathematics requirements not shared by other programs in this discipline? - Which of the following best describes how the certificates or degrees in your program connect to future credentials? <ul style="list-style-type: none"> o Our credentials are terminal. After our programs, there are no additional certifications or degrees at other institutions. o Our credentials could lead to additional credentials at other institutions.

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What should the survey look like?

Survey of Mathematical Skills

Which of the following best describe the skills your students need to develop?
Try to limit your select to (at most) five.

- ☐ Summarize and interpret data.
- ☐ Graph a large variety of algebraic functions.
- ☐ Apply logic and reasoning to solve problems.
- ☐ Model the real world, especially financial problems, using algebra.
- ☐ Model the real world using probability.
- ☐ Apply common probability distributions, such as normal and binomial.
- ☐ Apply the theory of functions.
- ☐ Reason using ratio and proportions.
- ☐ Use functions to model real-world phenomena.
- ☐ Evaluate all roots of higher degree polynomial and rational functions.
- ☐ Create and interpret graphical/tabular representations of data.
- ☐ Draw conclusions based on data.

Summary of Recommendations

1. Make the case with partner disciplines.
2. Communicate, communicate, communicate.
3. Focus on learning outcomes *NOT* courses.
4. Design for scale.
5. Considerations for survey instrument.

The Process

- Initial Communication
 - Articulate outcomes
 - Clearly define roles
 - (Emphasize communication is important)
- Prep Period
 - Math Department
 - Partner Discipline
- Meeting Engagement
- Submit Survey
- Analyze survey, schedules follow-up meeting with discipline, and makes recommendation for default math course.

Working model: Sample action steps and timeline

Meeting Preparation Advice	
Month 1 - Secure mandate from president/provost to achieve the goal. Send communication to deans and department chairs describing the work. Develop survey instrument.	
Month 2 - Have deans and department chairs select a single faculty point of contact. Communicate with all points of contact about expectations and answer any questions about the survey and student learning outcomes.	
Month 3 - Points of contact solicit input from departments during a faculty meeting. Points of contact submit surveys.	

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Activity: Discussion/reflection

Take a few minutes to discuss with your colleagues or reflect individually:



1. How can you use this tool to foster discussions between your discipline and a discipline other than mathematics?
2. How could you modify these templates to include more than these two disciplines in the discussion?
3. What is the value of including additional perspectives? Support service representatives? Instructional designers?

When you are finished, proceed to the next section.

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Review External Recommendations

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Part II: Review external recommendations

Purpose	Who Is Involved	Necessary Resources
Inform changes possibly made to course requirements and advising practices	Leadership team	<ol style="list-style-type: none"> 1. Institutional Transfer Data 2. State-Level Math Inventory Guide (if available) 3. Program of Study Briefs <ul style="list-style-type: none"> • Nursing • Criminal Justice • Communications • Social Work • Business • Pre-Service Elementary (K-5) Teacher Education

Overview of Part II

1. Review transfer data for your institution
2. Review math requirements at transfer institutions
3. Identify high priority programs.
4. Review the *Program of Study Briefs*.
5. Make recommendations for updating the *Alignment for Mathematics Pathways* inventory.

Background

Making the Case for Mathematics Pathways

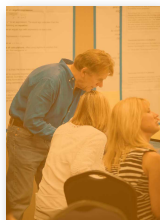
- [Modernizing Mathematics Pathways](#)*

Research from Professional Associations

- [Program of Study Issue Briefs](#)*

* These documents can be found at www.dcmathpathways.org.

Action Steps to Maximize Scale



Part III: Action steps to maximize scale

Purpose	Who Is Involved	Necessary Resources
Identify short- and long term action steps to scale math pathways implementation	Leadership team	1. Alignment of Mathematics Pathways Inventory

Overview of Part III

1. Conduct follow-up meetings
2. Take action steps to finalize pathways for the next academic year.
3. Finalize the inventory and disseminate information.
4. Update advising information and support the creation of advising tools
5. Identify targets for future changes beyond the next academic term.

Activity: Plan for action



Create a plan for having multidisciplinary discussions. Plan for how you will:

1. Name at least one specific action discussed today that you can most easily adopt right away.
2. Which action(s) do you think you'd like to do, if you had help.
3. What type of support do you need to lead this kind of change?

When you are finished, proceed to the next section.

Resources available

The Dana Center Mathematics Pathways Resource site,
www.dcmathpathways.org:

- Learn About: Essential ideas and resources targeted for essential stakeholders
- Take Action: Action steps and resources for institutional and classroom implementation
- Resources:
 - *The Case for Math Pathways*
 - Student and faculty videos sharing their experiences

Contact Information

- General information about the Dana Center
www.utdanacenter.org
- Dana Center Mathematics Pathways Resource Site
www.dcmathpathways.org
- To receive monthly updates about the DCM, contact us at
dcmathpathways@austin.utexas.edu

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.

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